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SEPTEMBER 1944

PUBLISHED MONTHLY BY AMERICAN MEDICAL ASSOCIATION, 535 NORTH DEARBORN STREET, CHICAGO 10, ILLINOIS. ANNUAL SUBSCRIPTION, $6.00

Entered as Second Class Matter Jan. 14, 1925, at the Postoffice at Chicago, Under the Act of Congress of March 3, 1879

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VOLUME 40 SEPTEMBER 1944 NUMBER 3

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TRAUMATISM OF THE FRONTAL SINUSES

RALPH A. FENTON, M.D.

PORTLAND, ORE.

While it might be possible to include under the heading of acute traumatism of the frontal sinuses such irritations and infective conditions as may occur following the sudden entrance of water or other fluid through the nasofrontal duct in diving, shipwreck and similar accidents, this review will be limited to such damage as may result from external and violent means causing bruises, fractures and dislocations of the frontal bone.

Fractures of the frontal bone, above all other breaks in facial bones, are beset with special danger because of the intimate relations of a cavity directly communicating with the airways of the nose with the dura, the frontal lobes of the brain, the olfactory nerves and bulb and the superior longitudinal sinus. While the superciliary arches when heavy afford protection, acting somewhat as do the malar bones with respect to the maxillary antrums, they may, on the application of sudden external violence, break away from the much thinner anterior walls of the frontal sinuses, or from the exceedingly thin orbital roof. Under such circumstances the heavy superciliary ridge may fracture backward through one supraorbital foramen or both; it may break away at either end, or it may be driven upward. Because of its weight and solidity, such a bone fragment, jagged at either end, becomes a dangerous missile for the transmission of force toward the cribriform plate, the orbital contents or the posterior wall of the frontal sinuses overlying the frontal lobes and the anterior end of the longitudinal sinus.

Fractures in which the frontal bone breaks away from the nasal and the ethmoid bones are relatively common, often without gross external deformity. They are evidenced by subcutaneous hemorrhage and by edema of the eyelids or chemosis affecting one or both eyes. Since in such cases there is little or no displacement, frontal roentgenograms from ordinary angles do not show anything.

The heavy superciliary ridges of the average adult man are in most instances sufficient to protect the sinuses from fracture, unless direct violence is concentrated at one point or crushing weight is applied. Women and children are somewhat more vulnerable, particularly when the head is smashed forward against the instrument board, a door handle, a metallic coat rail or the back edge of the front seat of an automobile.

In this connection it is curious to note that only one of the most ancient remaining skulls of primitive man—seen as a cast of the Neanderthal skull in the Chicago Museum of Natural History—shows a broken superciliary ridge with exposure of the underlying sinus cavity. This opening looks as if it might have been made by a blow with a flint ax or wedge. Examination of roentgenograms of numerous Egyptian mummies shows no evidence of damage to the frontal region.

Premature explosions in road blasts or mining, as well as bomb blasts or shell explosions in towns or cities, frequently produce crushing wounds of the superciliary ridges and anterior sinus walls, caused by flying stone or other hard structural fragments. Fragmentation of soft rock, coal, brick and pavement material occurs in explosions, with much scattering and implantation in the skin and the periosteum but comparatively slight damage of bone. Many persons with such injuries were brought in from trenches in northern France, where grenade explosions had spattered their faces with mud and rock particles; similar damage from coral fragments in South Sea atolls and from Sicilian and Italian limestone may be expected. The present helmet affords much better facial protection compared with that formerly issued.

When the frontal sinus has not been torn open, and bone fragments of the anterior wall remain solidly adherent to their periosteum, efforts should be made to restore the alinement of such fragments if the wound can be cleaned up readily. All powder, dirt, rock, glass or

From the Department of Otolaryngology, University of Oregon Medical School.

Read before the American Laryngological, Rhinological and Otological Society, New York, June 10, 1944.

cloth fragments contaminating the wound should be scrubbed or picked out, not only to avoid infection but to prevent unsightly discolorations below the surface of the skin. Plain soap and water are usually the best cleanser. Such areas were formerly painted over with iodine; now, tinctures of either merthiolate or metaphen or ointments containing sulfathiazole, 5 per cent, have their advocates.

Striking the forehead in a fall will usually fracture the ascending plate of the frontal bone rather than the superciliary ridge; in some cases the entire frontal plate is cracked upward away from the eyebrows, thus opening both frontal sinuses and tearing the pericranial membrane subcutaneously. Obviously, if preexisting infection of the sinuses is present, there is imminent danger of the development of osteomyelitis. Special headgear resembling football helmets is provided for tank personnel, to guard against this type of injury.

Osteomyelitis may also occur as a result of a severe bruise over the frontal region, where clots in the haversian canals become infected from venules arising from the hyperplastic mucoperiosteum of chronically involved sinuses. Similarly, it has been stated that bruising of the forehead has been responsible for localization of spirochetes in clogged capillaries, with eventual gummatous destruction of bone.

Neglect of such apparently superficial trauma may involve great danger, as in the case of a powerfully built Alaskan fisherman, who had been pitched forward violently by a heavy sea, striking his forehead against a motor casing. Previous to this injury, he had had "colds" and nasal discharge for some weeks. The forehead and the left upper eye lid remained swollen for several weeks, and because of severe headaches he was hospitalized in an Alaskan port, but roentgenograms taken at that time were said to be inconclusive. Because of recurrent headaches and occasional swelling of the upper eyelid, he returned three months later to his Oregon home. Roentgenograms again showed the sinuses apparently clear, but thick yellow discharge was coming from the left nasofrontal duct. For this reason, the sinus region was widely exposed by external operation, and the entire left anterior wall, still in place, was found avascular, soft and lifeless, while the floor of the left frontal sinus was missing. The sinus lining was thick and contained a number of small abscesses, and the lower part of the cavity was half full of thick mucopus. The mucoperiosteum of the posterior wall of the sinus was still thin, but a circular bony dehiscence, 6 mm. in diameter, exposed apparently normal dura. The edges of this bony aperture were smooth. Evidently the acute process had taken care of itself when the traumatized frontal plate and the thin sinus floor finally disintegrated and relieved the internal pressure. Light dusting with sulfathiazole powder, with care to avoid the exposed dura, and enlargement of the nasofrontal duct, with primary external suture, gave union by first intention. There was complete cessation of headache at once, with no discharge after ten days. Reliance on the apparently excellent but utterly misleading stereoscopic roentgenograms would in this case have been a fatal mistake.

Compound fractures of the uninfected frontal sinus may be kept clean by careful management, particularly since the sulfonamide compounds have become available for local and general use. Preservation of all bone fragments which retain periosteal covering, the surgical attendant lifting them by hooks and mosquito forceps, and careful protective dressings will often restore contours and avoid much plastic work later. Under conditions of the first world war, such fractures required dressing with pads kept moist with diluted solution of sodium hypochlorite N. F., the eyes being protected by sterile petrolatum. An injury of this type, a transverse gutter wound involving both frontal sinuses, with the left orbital roof badly splintered and the intersinous partition loose in the cavity, was caused by a flying shell fragment of low velocity. The eyebrows and the upper lids were drooping far below their normal level. Most of the anterior wall of each frontal sinus was gone. The dura was not exposed. Tension sutures, with hoisting of the eyelids and brows by collodionized bandage strips, brought the wound edges into fair apposition. Healing was complete in a month. After twenty-five years, this soldier has only a deep furrowed scar across the region of the eyebrows.

A shell fragment or a hard rock propelled by an explosive charge may impart to the fractured malar bone or to the external angular process of the frontal bone sufficient force to transform it into a vicious missile flying into the orbit, tearing the eyelids apart, splitting the orbital roof or blowing the anterior wall of the frontal sinus outward. Such effects come from laterally propelled jagged projectiles which, if they struck the forehead in an anteroposterior direction, would rapidly prove fatal. A machine gun bullet ordinarily traverses bony structures so rapidly that it does not cause much damage on entrance, but it blasts out of thick bone either a wide ring or a number of heavy splinters on the side opposite to the wound of entrance.

Thus, wounds of the soft parts are greatly enlarged by the destructive sweep of bone fragments. One of the most startling World War casualties of this type was only a few feet away from a heavy caliber shell which tore off his right arm and scapula; a big steel fragment struck the right malar bone and ripped away the right antrum and orbit, the floor of both frontal sinuses, the anterior walls of the ethmoid sinuses, the nasal bones, the cribriform plate and most of the nasal septum. The left eye was crushed and its lids partially torn off. An area of dura 3 by 4 cm. was exposed, uncovering both frontal lobes above the orbits. Though the victim was in profound shock, it was possible to clean up this vast wound and pack it loosely with pads saturated with diluted solution of sodium hypochlorite N. F., and the soldier was evacuated by ambulance after a week. He survived to reach a hospital in the eastern part of the United States, where he died eighteen months later from an abscess of the left frontal lobe, which followed an acute infection of the upper respiratory tract.

Another man with extraordinary vitality came in as a sitting patient, and in the press of emergency surgical operations he was sent to a ward without treatment for what seemed to the surgeon in charge of triage only a bruised eyelid. Examination next morning disclosed that part of the nose of a 177 mm. shell had entered the palpebral fissure crosswise, destroyed the eye, turned upward, torn the floor out of the right frontal sinus, passed through the frontal and temporosphenoidal lobes, missing the middle meningeal artery, split the squama of the temporal bone and lodged under the temporal muscle and scalp. Such tremendous destruction of brain substance led rapidly to coma, and death followed within forty-eight hours. Lesions of the dura and the frontal lobes occurring as a result of compound fractures of the posterior walls of the frontal sinuses always carry a grave prognosis.

It should of course be evident that direct violence to the heavy superciliary ridge may fracture it inward, away from the nasal bones and into the sinus cavity. Such crushing blows may occur not only in automobile, tank and airplane accidents but also in mine, ship, train and elevator injuries in which the head is caught between beams or by doors or hatches. Such injuries are usually associated with fractures of the far more vulnerable bones of the cranial vault. Concussion and shock here outweigh the frontal damage. Obviously, the brain surgeon should have charge of any case in which acute traumatism of the posterior wall of the frontal sinus is suspected, particularly if symptoms of concussion are present. No considerations of cosmetic expediency should interfere with free access to such a field; preservation of life is the only objective.

The plastic repair of deformities arising from such injuries lies outside the scope of this paper, and such complications as osteomyelitis are now well understood and their management is standardized. It might be pointed out that recent army experience with frontal osteomyelitis of traumatic origin has convinced otolaryngologists in service of the great value of penicillin administered both intravenously and by local application. Removal of bone is said to be reduced to a minimum, and healing is exceedingly prompt. It is also reported from one army hospital that healthy costal cartilage secured at routine postmortem examinations is being preserved with merthiolate–saline solution in refrigeration, for eventual use in the plastic repair of frontal and other facial defects. It is hoped that full reports on these matters, including the use of tantalum prostheses, may be made generally available before long through the excellent bulletins which are now being issued by the Surgeons General of the Army and Navy.

806 Medical Arts Building.

VERTICAL NYSTAGMUS PRODUCED BY PERIPHERAL LABYRINTHINE LESIONS

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Vertical nystagmus is generally considered one of the most important signs in arriving at a differential diagnosis between a lesion of the peripheral labyrinth and a lesion of its central nuclei and pathways. As a rule, vertical nystagmus appears nearly exclusively in the latter group, and a lesion restricted to the vertical canals so that vertical nystagmus is produced is exceptionally rare. In former publications [1] we pointed to the necessity of revising the view that vertical nystagmus indicates only a lesion of the cranial part of the vestibular nuclei. We were able to demonstrate that such a nystagmus may also be produced by cerebellar lesions, particularly those affecting the lobus posterior medianus. The present study is a further contribution to the differential diagnostic significance of vertical nystagmus in that it demonstrates various types of peripheral labyrinthine lesions that may produce this form of nystagmus.

PUNCTURE OF THE ROUND WINDOWS

In experiments in which for other reasons the round windows were bilaterally punctured in cats, we observed that this operation often was followed by marked vertical nystagmus. The phenomenon was present in 5 of 10 cases and in 1 instance oblique nystagmus, beating to the left and somewhat upward, appeared, while in the other instances transitory horizontal undulation of the eyeballs or weak horizontal nystagmus followed the operative procedure. The vertical nystagmus usually was directed toward the upper lid; it had a frequency of from 5 to 100 per minute. In some cases it was influenced by the posture of the head in that it decreased in frequency and intensity when the head or the whole animal was in the supine position, with the head and the trunk in a fixed relationship; sometimes it decreased also when the animal was in the lateral position. In some instances postural changes influenced also the direction of this nystagmus. In 1 cat the nystagmus to the upper lid was reversed in the supine position, beating to the lower instead of to the upper lid, and was changed into a horizontal nystagmus to the right in both lateral positions. In a second animal the oblique (↗) was changed into a rotatory (↷) nystagmus in the right lateral position. This nystagmus was rather short lived: Sometimes it lasted only for a few minutes; usually it was no longer noticeable one hour after operation.

One is first confronted by the question whether one deals with a symptom of irritation or one of paralysis. One could suspect that changes of intralabyrinthine pressure produced by escape of perilymph produced symptoms of irritation. The transient nature of the disturbance was in agreement with this interpretation but made it difficult to test quantitatively the excitability of the labyrinthine receptors during the presence of the upward (↑) nystagmus. This interpretation was also corroborated by the fact that Tamari [2] observed a patient with a bilateral fistula symptom in whom upward (↑) nystagmus could be produced by bilateral simultaneous compression of the air in the external meatus, and Sommer,[3] a similar patient in whom vertical nystagmus could be elicited by aspiration also.

In later stages following puncture of both round windows, definite symptoms of hypofunction of labyrinthine receptors were found. There were definite pendular movements of the head and titubation on standing and walking, and a comparison of the excitability of the cristae ampullares by rotation before and after puncture of both round windows in cats revealed a definite

Read at the meeting of the Philadelphia Laryngological Society, March 15, 1944.

From the Department of Experimental Neurology, Temple University School of Medicine.

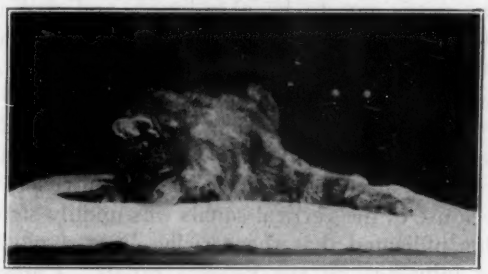
1. Spiegel, E. A., and Scala, N. P.: Vertical Nystagmus Following Lesions of the Cerebellar Vermis, Arch. Ophth. **26**:661 (Oct.) 1941; Positional Nystagmus in Cerebellar Lesions, J. Neurophysiol. **5**:247, 1942.

2. Tamari, M.: Beiderseitiges Hennebertsches Fistelsymptom, Monatschr. f. Ohrenh. **62**:1246, 1928.

3. Sommer, I.: Beiderseitiges Fistelsymptom bei kongenitaler Lues, Monatschr. f. Ohrenh. **66**:348, 1932.

decrease and often even an absence of the ocular reactions to rotation several hours after this operation and also on subsequent days.[4] Symptoms of hypofunction may also be noticed after puncture of one of the round windows. Biehl [5] found transient deafness in 2 patients in whom he performed this operation for the relief of increased intracranial pressure. Arndts [6] and McNally [7] observed hypotonia in the homolateral extremities in rabbits following unilateral puncture of the round window. We were able to confirm this observation. In cats we noticed nystagmus to the normal side lasting up to three hours.

In cats the puncture of a round window also seems to induce hypofunction of the maculae, although such an effect may remain unnoticed in otherwise normal animals and may be demonstrated by special methods only. One of these methods is the production of catalepsy with bulbocapnine. Krisch and Spiegel [8] demonstrated



In this cat the right round window was punctured. Catalepsy was produced by a subcutaneous injection of 100 mg. of bulbocapnine phosphate. The head rotated (around the dorsoventral axis) and turned (around the oro-occipital axis) to the right.

that latent disturbances of tonic innervation may become manifest in this cataleptic state, and Sager and Kreindler [9] used the method in order to make disturbances of tonus distribution following unilateral labyrinthectomy more obvious. It proved useful also in our study. The accompanying figure shows an experiment: While unilateral puncture of the round window of this cat was not sufficient to produce a definite anomaly of the posture of the head, definite rotation and turning of the head toward the operated side appeared in catalepsy induced with bulbocapnine. The posture of the head closely resembled that seen in otherwise normal animals following unilateral labyrinthectomy; this anomaly of posture indicated that in cats unilateral puncture of the round window produces at least a latent decrease in the state of excitation of macular receptors on the affected side.

Thus in cats puncture of a round window reduces the excitability of the receptors in the cristae ampullares and also diminishes the state of excitation of the maculae. However, it does not produce complete paralysis of the labyrinth, since manifest symptoms, such as abnormal posture of the head, are not elicited by this procedure. These later symptoms of hypofunction do not preclude the possibility that the puncture produces irritational phenomena immediately following operation.

COCAINE PARALYSIS

A somewhat different type of vertical nystagmus could be observed in further experiments in which we produced gradually developing paralysis of the labyrinth by injecting a 2 per cent solution of cocaine hydrochloride in 80 per cent alcohol into the tympanic cavity of the cat. The cocaine solution diffuses into the inner ear and produces signs of paralysis of the labyrinth (nystagmus to the opposite side, inclination of the head to the same side on unilateral application). When this method was applied bilaterally, we observed the appearance of vertical nystagmus about fifteen to twenty-five minutes after the solution of cocaine had been injected into the tympanic cavities. This nystagmus usually beat with the fast component toward the lower lid, was most marked when the head or the whole animal was in the supine position, with head and trunk in a fixed relationship, and lasted from twenty to sixty minutes.

It seems easier to answer the question whether one deals with a symptom of irritation or one of paralysis in this series of experiments than in the experiments with bilateral puncture of the round window.

If one injects a solution of cocaine into the middle ear unilaterally, irritative phenomena preceding the paralysis should be manifested by a nystagmus to the side of injection preceding the paralytic nystagmus to the normal ear. However, after such unilateral injections only the

4. Following bilateral puncture of the round windows in rabbits, Arndts [6] found normal reaction of the eyeballs to rotation, probably because his punctures were superficial.

5. Biehl: Eröffnung des runden Fensters, Acta oto-laryng. **8**:70, 1925.

6. Arndts, F.: Neue Beobachtungen über den Zusammenhang zwischen Labyrinth und Extremitätentonus, Arch. f. d. ges. Physiol. **212**:204, 1926.

7. McNally, W. J.: Punktion des runden Fensters beim Kaninchen, Acta oto-laryng. **11**:460, 1927.

8. Krisch, H., and Spiegel, E. A.: Sichtbarmachung latenter Tonusstörungen mit Bulbocapnin, Ztschr. f. d. ges. Neurol. u. Psychiat. **122**:535, 1929.

9. Sager, O., and Kreindler, A.: Action de la bulbocapnine, in Volume jubilaire en l'honneur du Professeur G. Marinesco, Bucarest, Societé Roumaine de Neurologie, Psychiatrie et Endocrinologie, 1933, p. 599.

latter type of nystagmus, that directed to the healthy side, appears. It seems, therefore, justified to assume that the vertical nystagmus produced by the bilateral injections of the cocaine solution is a symptom of paralysis. The fact that this nystagmus beats toward the lower lid, i. e., in a direction opposite to that appearing after bilateral puncture of the round window, seems in agreement with the assumption that one deals in the latter case with a symptom of irritation and in the former instance with a symptom of paralysis.

Partial paralysis of both labyrinths could induce vertical nystagmus in various ways. With paralysis of both horizontal canals, continuous tonic impulses from the vertical canals could become released and act on the vertical motor muscles unimpeded by tonic effects of the horizontal canals on the muscles for lateral ocular movements. In order to test this possibility the excitability of the horizontal canals was studied during the downward nystagmus (↓) that appeared after bilateral injection of the cocaine solution. It was found that the spontaneous vertical nystagmus developed rather independently of the state of excitability of the horizontal canals. Cases were observed in which the vertical spontaneous nystagmus was associated with decreased excitability of the horizontal canals, as well as instances in which it was accompanied by normal excitability of these canals.

As has been mentioned in the introduction, lesions in the cranial part of the vestibular nuclei are able to produce vertical nystagmus, apparently by causing an imbalance between the vestibular nuclei of the left and those of the right side. Similarly it could be conceived that one deals in these experiments on the peripheral labyrinths with an imbalance between the state of excitation of the left and that of the right labyrinth. This imbalance could be caused by differences in the rate at which the cocaine solution diffuses into the inner ear. An imbalance between the left and the right labyrinth usually manifests itself chiefly by mixed (rotatory-horizontal) nystagmus to the less affected side, and indeed this type of nystagmus was occasionally observed in these experiments. If one wishes to explain the appearance of downward nystagmus (↓) by an imbalance between the labyrinths, one has to assume that in the stage when this vertical nystagmus appears all receptors causing vertical ocular movements in one labyrinth and only the receptors causing upward movement in the other labyrinth are paralyzed. The additional, as yet unproved, assumption would be necessary that the receptors causing upward ocular movements are paralyzed more easily than the antagonistic receptors. It seems still more important that the influence of position on the intensity of the vertical nystagmus remains unexplained by such a theory.

Another possibility, therefore, seems to merit consideration, namely, that in these experiments with cocaine one deals with partial paralysis of receptors in the maculae.

In recent years the assumption has not infrequently been made that a disease of the otolithic apparatus was present when one observed nystagmus appearing in certain positions only or influenced in its characteristics by the position of the head. Ruttin [10] pointed out that stimulation of the otoliths normally produces at most a rotatory reaction of the eyeballs but not nystagmus. Thus, if under pathologic conditions nystagmus appears in certain positions of the head, the phenomenon can hardly be ascribed to stimulation of the otolithic apparatus. It seems, however, that the conception of a disease of the otolithic apparatus in cases of positional nystagmus needs not to be abandoned, and that this phenomenon may be explained as due to a disturbance in the functional relationship between maculae and cristae ampullares. A number of experiences point to such a relationship. McNally [11] and Tait and McNally [12] observed that in frogs after elimination of the utricles the response of the vertical canals was unduly strong. This indicated that the utricles exert a modifying influence on the vertical canals. Chiloff [13] demonstrated that in normal human subjects and in cats, excitation of the otoliths by changing the position of the head decreased the duration of postrotatory nystagmus by an inhibitory influence of the otoliths on ocular reactions originating in the frontal semicircular canals. These phenomena may perhaps serve as a basis for an understanding of positional nystagmus in labyrinthine diseases that partially paralyze the maculae and also for an understanding of the positional influence on the spontaneous vertical nystagmus that follows bilateral injections of cocaine solution. In both instances one may deal with phenomena of a release of semicircular canal receptors from a dampening influence normally originating in the maculae. If the

10. Ruttin, E.: Nystagmus bei Lagewechsel, Ztschr. f. Hals-, Nasen- u. Ohrenh. **27**:606, 1930.

11. McNally, W. J.: Experiments Demonstrating the Interaction of the Semicircular Canals and the Utricles, Tr. Am. Acad. Ophth. **38**:265, 1933.

12. Tait, J., and McNally, W. J.: Some Features of the Action of the Utricular Maculae, Phil. Tr. Roy. Soc., London, s.B **224**:241, 1934.

13. Chiloff, C. Z.: De l'influence de l'irritation des otolithes sur les reflexes des canaux demicirculaires, Rev. de laryng. **48**:691, 1927.

maculae are only partly paralyzed, the release of vertical ocular movements could be more marked in some positions of the head and less definite in others, so that the influence of position on this nystagmus could find an explanation.[14]

The following working hypothesis is offered as a basis for further studies. One may assume that in each labyrinth receptors are present tending to produce upward ocular movements, as well as receptors influencing the eyes in the opposite direction. Normally there is an equilibrium between these antagonistic receptors, which are dampened by the maculae. This dampening influence is normally so strong that differences in the prone and in the supine position do not become manifested. When the maculae are partially paralyzed by cocaine, the inhibitory influence on those receptors that induce downward ocular movements is decreased. This decrease of the inhibition becomes apparent particularly in the supine position, indicating that the inhibitory influence of the maculae is normally weaker in this position. This would also explain why the upward nystagmus appearing after puncture of both round windows is more marked in the prone position. The forces inducing upward ocular movements can be more effective in this position because the antagonistic downward forces are more dampened by the maculae. After puncture of the round windows purely mechanical factors, producing differences of intralabyrinthine pressure in the supine and in the prone position, may also play a part.

From a practical point of view, it seems worth recording that disturbances bilaterally affecting the inner ear may be associated with transitory vertical nystagmus, so that differential diagnostic considerations of this symptom have to include central as well as peripheral lesions.[15]

SUMMARY

Vertical nystagmus may appear, on the one hand, in association with lesions of the central nervous system affecting cranial cell groups of the vestibular nuclei or posterior parts of the cerebellar vermis and, on the other hand, in association with some types of lesions of the inner ear. It was observed following puncture of both round windows and in gradually developing bilateral paralysis of the labyrinths induced with cocaine.

The mechanism of these phenomena possibly is that of a release of semicircular canal receptors from a dampening influence normally originating in the maculae, through partial paralysis of the latter.

Latent disturbances of tonus innervation produced by puncture of the round windows may become manifest in catalepsy induced with bulbocapnine.

14. Such a functional relationship between maculae and cristae may also shed some light on the observation that bilateral irrigation of the ears with cold water may induce vertical nystagmus in certain positions of the head (Fischer, M. H.: Beiträge zur Physiologie des menschlichen Vestibularapparates. V. Bilateralmethoden, speziell Doppelspülungen. A. Nystagmus, Arch. f. d. ges. Physiol. **213**:74, 1926).

15. A case observed by Mackenzie seems to belong in this group of cases of vertical nystagmus produced by peripheral labyrinthine lesions (Mackenzie, G. W.: Report of a Case of Focal Infection Neurolabyrinthitis Manifesting Nystagmus of a Character Assumed to Be of Purely Cerebellar Tumor Origin, Laryngoscope **40**: 192 [March] 1930). The author interprets the case as one of neurolabyrinthitis due to the presence of a focus of infection in the alveolar process. As in our experiments with bilateral paralysis of the labyrinths induced with cocaine, there was in this patient vertical nystagmus downward, appearing particularly when the head was in the 90 degree forward position, that is, with the face directed toward the floor.

PSEUDOMEMBRANOUS ANGINA FOLLOWED BY PARTIAL PHARYNGEAL PARALYSIS

CAPTAIN JOSEPH V. M. ROSS

MEDICAL CORPS, ARMY OF THE UNITED STATES

Vincent's infection with its many varied expressions is a common disease among German prisoners of war at the camp from which this report is made. Statistics gathered by the dental department at the station hospital reveal an unusually high incidence of neglect of oral hygiene in these prisoners. Whether this is a wilful neglect or a temporary exigency is rather difficult to ascertain. War and related factors (nutritional deficiencies in childhood resulting in poor substructure, new environments, exposure to new types of diseases and emotional stress and strain) have led to diminution in their overall bodily resistance, particularly their ectodermal resistance; their mesoderm, too, has betrayed in many instances an original lack of resistance as well as a subsequent decline of what might have been present originally.

REPORT OF TWO CASES

This is not intended to be an ultrascientific report, with so many dissections that the original anatomy is no longer recognizable, but only a brief report of 2 cases of pseudomembranous angina seen in the eye, ear, nose and throat department of the station hospital which attracted more than usual interest. In a prisoner of war camp of this sort, only the simplest (and most easily forgotten) methods of investigation are available since general hospitals are close and patients with unusual conditions transferred with ease, circumstances which, however, tend to improve rather than dull one's diagnostic acumen.

Both of the patients were male prisoners of war, aged 21 and 22, respectively, and since their complaints and the findings were similar, both cases will be discussed together. The complaints on admission were fever, headache, some vague generalized malaise, gastrointestinal disturbances with nausea, sore throat and difficulty in swallowing. The history of their illness revealed only that both had had their complaints for two days before being hospitalized and that both had become suddenly worse the night before hospitalization. In each case the past medical history was irrelevant, as was the family history. The findings were those of Vincent's angina of a severe type, with typical lesions of the throat, extreme dysphagia, pronounced fetor oris, evident submaxillary and cervical lymphadenopathy and hemoptysis. There was no obvious involvement of the gums. The blood counts ruled out agranulocytosis and the leukemic varieties of blood dyscrasia and the smears and cultures of material from the throat excluded diphtheria.[1] The involvement of the throat seen on admission cleared rather rapidly with the usual therapy for Vincent's angina. It was the appearance of symptoms referable to the nervous system and the neurologic findings that provoked further investigation, although the symptoms in one patient were looked on at first rather unconcernedly and dismissed as casual, as was the patient.

Some of the other important observations during hospitalization were as follows: For the first six days of their illness their temperatures varied from 99 to 103 F. but were normal thereafter. The curves of their sedimentation rates were such as are seen in cases of acute infection. (The method used was that of Cutler.) The red blood cell counts were normal; in one case there was definite leukocytosis with granulocytosis; in the other the white cell count was normal. The Kahn tests were negative. The urinalyses gave negative results except for a few red blood cells and white blood cells in each case. Smears of material from the throats revealed Vincent's organisms in each case; some other normal inhabitants of the upper respiratory tract were seen. Cultures of material from the throats showed no diphtheria bacilli. The patients were confined to the hospital for eleven days and twenty-seven days, respectively. On discharge both complained only of slight weakness, but one remarked that his voice had a peculiar nasal tone, which had developed about four days before his departure from the hospital.

Both of these patients were seen in the eye, ear, nose and throat clinic subsequent to leaving the hospital—one four days after discharge and the other seven days after discharge. Both had the same complaints: difficulty in phonation with a nasal twang to the voice; difficulty in swallowing both solids and fluids, the former eliciting vague pain in the throat, the latter nasal regurgitation, with cough accompanying both. Both patients mentioned a peculiar sensation in the throat which they could not accurately describe but which implied that the throat was "weak." Some of the important questions which arose and the observations made will be summarized in following paragraphs. Although properly some of the findings were referable to the mouth and fauces, these are so intimately associated with the pharynx physiologically, particularly as pertains to these cases, that a separate discussion seems unwarranted.

The symptoms occurred fifteen and twenty-three days, respectively, after the original illness. There had been no previous attacks. For the first four days of observation there was an average temperature of 99 F., after which the temperatures were all normal. The blood counts were normal.

1. These, of course, are not the only diseases that entered into consideration in differential diagnosis.

Urinalyses gave negative results. The sedimentation rates were normal. The sinuses were normal by transillumination and on routine examination. The nasal conditions were essentially normal. There was no evidence of chronic angina, chronic tonsillitis, retropharyngeal abscess or other gross pathologic changes. The larynx, examined by mirror, showed no abnormalities. There was no aural involvement. There was no respiratory distress.

One patient complained of difficulty in reading. On Nov. 13, 1943, during his stay in the hospital vision was 20/20 in each eye and Jaeger's test type 1 was read at 14 inches (35.5 cm.) with each eye. On December 13 his complaints were all referable to difficulties with near vision. Vision then was 20/30 in each eye and Jaeger's test type 3 was read at 14 inches with each eye. On December 31, retinoscopy with use of a cycloplegic agent revealed:

Right eye: +2.00 with +0.25 cyl. axis 170 = 20/20
Left eye: +0.25 with +0.25 cyl. axis 60 = 20/20

On Jan. 8, 1944 manifest examination revealed:

Right eye: +1.00 with +0.25 cyl. axis 170 = 20/20
Left eye: +0.25 with +0.25 cyl. axis 45 = 20/20

At this sitting the patient stated that his eyes felt better, and vision was 20/20 in each eye and Jaeger's test type 1 was read at 14 inches without glasses.

No vasomotor facial disturbances were observed. The motor functions of the tongue were normal. As to taste, only the anterior two thirds of the tongue was tested. On Dec. 15, 1943 there was no impairment of taste in the anterior left two thirds of the tongue in each case. On Jan. 10, 1944 the same result was obtained. The neurologic observations on the throat were as follows: On Dec. 15, 1943 there was left hemianesthesia of the pharynx in each throat as tested by hypodermic needle. On Jan. 10, 1944 it had entirely disappeared in one throat, and there was residual dulness of sensation in the other. In regard to motor functions of the pharynx, on Dec. 15, 1943 the left side of the pharynx in each case was relaxed and immobile, as was the velum, both at rest and during attempted action of the throat; on purposeful pharyngeal movement the uvula was pulled to the uninvolved, mobile side. There was no nystagmus-like movement of the uvula. The pharyngeal reflex was elicited only by touching the uninvolved side. On Jan. 10, 1944 there was some residual pharyngeal weakness on the left in one case.

No other muscular involvement (trapezius muscle and others) was noted.

In one case nasal regurgitation of fluid is still present at this writing, of thirty-six days' duration; in the other it is no longer present, having lasted thirty-four days. The nasal twang persists in each case, having lasted thirty-six and forty-four days, respectively. The dysphagia with solids persisted for twenty-four days and twenty-eight days, respectively.

One of the patients presented a nodular enlargement of the thyroid gland, but the presence or absence of toxicity has not been determined as yet. His disease was the less severe throughout.

In smears of material from the throats gram-positive and gram-negative diplococci were seen; a few gram-positive streptococci in chains were noted in one case. Cultures of material from the throats yielded growths of gram-positive diplococci in each case. No hemolytic streptococci or diphtheria bacilli were found.

The dental report in case 1 listed the following abnormalities: malocclusion of the medium, thumb-sucking type; teeth missing (right 6 and 14, left 4, 5, 6, 14 and 16); carious teeth (right 15, left 15); nonvital teeth (right 1 and 2, left 1 and 2—all of which have improper fillings of root canals and two of which, right 2 and left 2, have undergone apicectomy); periapical abscess (distal root of right 15, and right 5, the abscess of which has a fistulous opening). Also noted was slight periodontoclasia in the region of the lower left bicuspid and first molar teeth, due to movement of right 15, thereby partially closing the space caused by the extraction of right 14. A smear examined for Vincent's organisms showed none. The dental examiner recommended extraction of all teeth and alveolectomy in anterior regions, above and below.

In case 2 the dental report listed the following abnormalities: malocclusion of a severe type, with protrusion of the mandible; teeth missing (right 3, 6 and 14, left 14 and 15); carious teeth (right 7, 8 and 16, left 6), nonextensive; a deciduous tooth (left 13); a tooth to be extracted, left 7 (root); periodontoclasia, slight, in the lower anterior region. A smear for Vincent's organisms showed none. Owing to the severe malocclusion making it almost impossible to masticate food, extraction of all upper and lower teeth and mandibular alveolectomy were recommended.

COMMENT

Since the library facilities of this station hospital are limited, I do not know how common the aforementioned neurologic findings are as sequelae of Vincent's angina. I have seen such changes complicating streptococcic, staphylococcic and diphtheritic infections of the pharynx (and larynx) but not complicating Vincent's angina. Conversations with other otorhinolaryngologists in this section revealed no experiences in this regard, and correspondence with some others and correspondence library facilities seemed to uncover no other definite cases.

The important question that immediately arose was the singularity of the diagnosis of Vincent's angina. Probably some ingenious methods could have been devised either to substantiate this diagnosis more specifically or to decide the issue rather definitely otherwise, but here the final decision was influenced by the overwhelming clinical and laboratory evidence. The lack of involvement of the gums was a disturbing bit of testimony in favor of some condition other than Vincent's angina. But what other?

Then another question presented itself: If it was possible to label this disease condition as pseudomembranous angina, what was the etiologic significance of the Vincent's organisms? If they were not causative, they were certainly associated with, and active in relation to, the disease process, as evidenced by their large numbers. No attempt was made to culture them, for their abundance precluded the necessity of it, but diplococci and short-chained streptococci were found on all smears, and only the gram-

positive diplococci were grown (i. e., on aerobic mediums), which revives the question of how much part such organisms play in this type of disease process.

According to the dental reports, the usual factors predisposing and contributing to Vincent's angina were present in each case with the exception of gingival involvement, the patient with the worst dental report having the worst clinical findings (and for the longer period) by far. But there were apparently no systemic expressions of fatigue, debility and the other conditions generally cited as favorably influencing the growth of Vincent's organisms to the point that symptoms and signs of the disease are seen and the diagnosis made.

The possibility that some virus was at work might be proposed since viruses are known to possess neurotoxic properties, whereas I know no neurotoxic properties of Vincent's organisms nor the exact nature of their toxins if such there are. Certainly, if the destruction and necrosis of tissue as well as the systemic symptoms encountered in the disease are due to these organisms, the possibility that there are toxins would seem more assured.

Nothing was found to aid in explaining the mechanism involved. It could have been an allergic response to the original infection, or some endotoxins or exotoxins might have affected the muscle and nerve fibers so as to produce the symptoms experienced. Or there could have been some simple mechanical physiologic hindrance produced by extracellular and/or intracellular infiltration and edema. This explanation would be more tenable during the stage of visible pharyngeal swelling. If the muscles, and not the nerves, were involved, one could speak of paralysis but one could not correctly interpret the observations as belonging to the neurologic category. It is difficult, however, to visualize an inflammatory process severe enough to produce damage to muscle fibers and harsh enough to disturb function without concomitantly producing some damage of the nerves in that particular area, thereby producing localized peripheral neuritis, be it interstitial or parenchymatous.

It is only of academic interest to attempt to discover accurately what branches of what cranial nerves were involved, but some few tests were used to discover whether cranial nerves other than those supplying the throat and mouth were implicated; likewise, whether the upper cervical region of the cord and the sympathetic nerves in this region were involved. Apparently only the fifth, ninth, tenth and possibly eleventh cranial nerves were affected. I cannot definitely decide whether the inhibition of accommodation possibly experienced by one patient was an expression of partial involvement of the third nerve or not.

Both patients are at present under treatment with the vitamins which are supposed to influence nerve tissue to better physiologic action, and progress has been noted as outlined in foregoing pages.

SUMMARY

Two cases of Vincent's (pseudomembranous) angina were complicated with late partial pharyngeal paralysis. The patients were German prisoners of war, aged 21 and 22. The clinical expressions in the former were milder throughout the entire course of the disease. It was not possible with the facilities available to determine accurately the etiologic factors and the mechanism of the complication. Though the axiom of endeavoring to explain all clinical expressions by one disease process was heeded, there might have been present two disease entities, interdependent or separate, or a peculiar throat syndrome with various factors involved, some secondary and some causative.

With routine vitamin B complex therapy slow progress has been observed.

It is hoped that this report may serve as a stimulus for further investigation of the type of anginal syndrome described.

Major George W. McDaniel, Dental Corps, Army of the United States, chief of the dental section, and the entire staff, of the station hospital cooperated in the study of these cases.

MANAGEMENT OF THE ALVEOLAR FISTULA

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The antroalveolar fistula might be defined as a condition produced by the dentist to tax the ingenuity of the rhinolaryngologist. Of course, this is not quite true for several reasons. While the vast majority of these fistulas result from the extraction of teeth having roots entering into or in close proximity to the floor of the antrum, or from injury to the floor incident to extraction, a smaller number may be due to other conditions, such as cysts or cancer. Further, many heal spontaneously or with a modicum of intelligent management. And many never come to the attention of the rhinolaryngologist but are handled by the dentist or the oral surgeon. But a fistulous tract of any size from the mouth with its rich and variegated bacterial flora to the antrum is most liable to result in infection of the sinus, if indeed this is not already present. Control of such fistulas is dependent on control of the sinusitis and calls for the service of one trained in this field.

The importance of cooperation between the dentist, the oral surgeon and the rhinolaryngologist has been stressed by Dunning,[1] Brown,[2] Lyons[3] and others. Perhaps this cooperation has been exemplified best in the field of prevention by the dentist considering the condition of the antrum, as well as the relation of dental roots, prior to extraction and exercising due caution in curettage of the socket, and by the rhinolaryngologist keeping in mind the question of

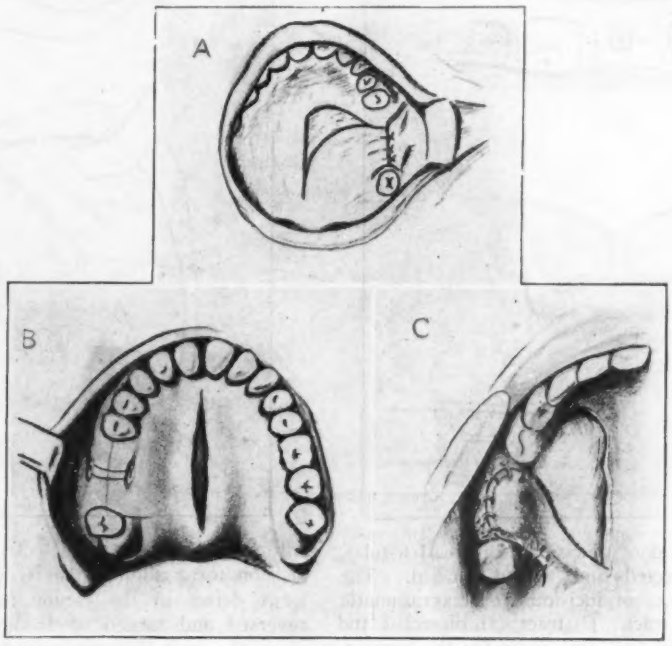

Fig. 1.—*A*, Dunning pedicle flap from the palate, sutured to the margin of the labial mucosal flap. *B*, Welty palatal flap. A long median incision is made with elevation of the palatal mucosa; the alveolar process is taken down, allowing approximation to the small labial flap. *C*, Ashley palatal flap with the anterior end, which has been denuded of mucosa, forming a plug in the opening.

From the Thayer Hospital.

Read at the meeting of the Eastern Section of the American Laryngological, Rhinological and Otological Society, New York, Jan. 14, 1944.

1. Dunning, H. S.: Maxillary Sinus of Oral Origin, Laryngoscope **35**:766 (Oct.) 1925.
2. Brown, L. E.: Relationship of Teeth to Pathology of the Maxillary Sinus, Ann. Otol., Rhin. & Laryng. **34**:150 (March) 1925.
3. Lyons, H. R.: Treatment of Alveolar Fistula Secondary to the Extraction of Teeth, Tr. Am. Laryng., Rhin. & Otol. Soc. **31**:81, 1925.

dental pathologic results before operating on the antrum. When extraction has indicated an opening through the antral floor or there are symptoms of sinus infection, the modern dentist usually recognizes the situation and seeks the assistance of the rhinolaryngologist.

In these cases there is one prevailing hazard, gravity drainage into the mouth, and there is one main principle in management, control of the sinus infection.

Early attention, directed primarily toward the antral infection, may result in spontaneous closure of the fistula or in satisfactory response to simple curettage of the tract and suturing. When clinical and roentgen studies indicate that the lining mucosa is fairly normal, the common measures used to promote drainage through the

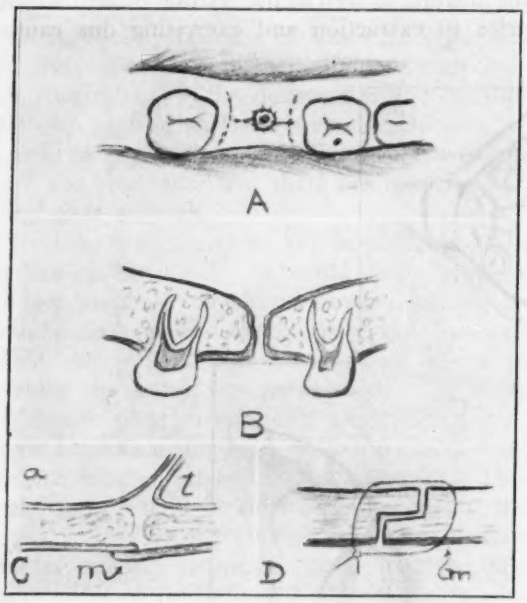

Fig. 2.—*A*, "folding door" incisions for small fistulas, the tract being dissected and turned inward. The drawing shows the lines of incision. *B*, diagrammatic representation of the tract. *C*, tract (*t*) dissected and turned into the antrum (*a*). (*m*) indicates the mucosa. *D*, method of suturing the mucosa (*m*) to effect a stronger union.

ostium, such as displacement, may suffice. At times irrigation, done preferably by puncture through the inferior meatal wall and not repeated too often, may be indicated. When the lining mucosa is thickened and there is evidence of preexisting chronic sinusitis, an intranasal antrotomy is indicated. Little is to be gained by procrastination. Intranasal drainage should be established as early as possible. The removal of secretions by the suction cannula through the antrotomy opening is helpful and much preferable to lavage.

If the fistula does not heal after such simple measures have been taken, plastic operation will be necessary. For a small fistula the procedure of undermining the mucosa, turning the lining of the tract inward and suturing the mucosal flaps often proves successful.

The management of a fistula of long duration, especially one of large size, may prove rather complicated. The antrum is always infected and

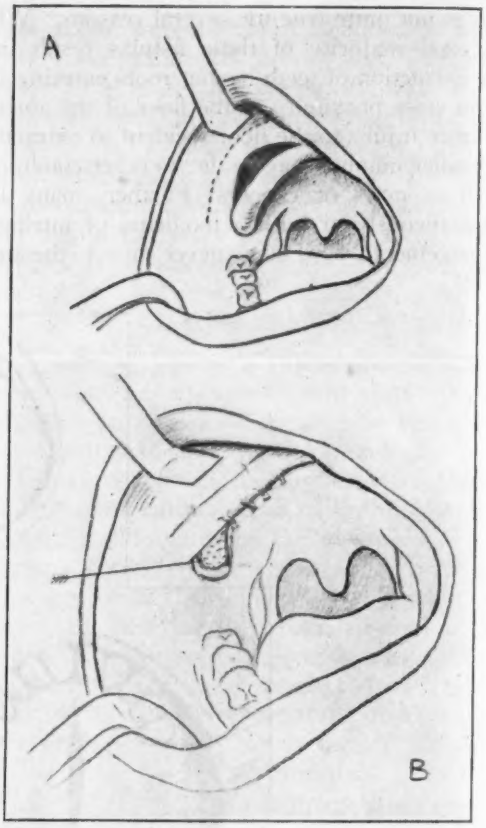

Fig. 3.—*A*, operative defect in the canine fossa. The incision for a sliding flap is outlined. *B*, closure of a large defect in the canine fossa. A hinged flap is reversed and turned up from the alveolar process to close the posterior angle and provide a raw surface for a sliding flap. The sliding flap of buccal mucosa is brought down to meet the flap elevated from the alveolar process. The buccal mucosa is undermined sufficiently to allow the buccal incision to be loosely approximated. At times this procedure may be combined with elevation of a palatal flap. An arrow indicates the reversed flap.

can best be approached through the canine fossa. The Caldwell-Luc operation should be combined with or followed by a plastic procedure on the fistula. Occasionally, in cases in which the sinus is badly infected, a two stage procedure may be advantageous, allowing the infection to subside before attempting the plastic procedure. In the interim the saddle plate, as suggested by

Dunning,[1] may be used to prevent upward seepage from the mouth to the antrum.

A number of technics have been suggested, all based on the principle of dissection of the fistulous tract and covering of the defect with adjacent mucosa. Dunning [1] has used a rather large palatal flap which is adaptable in most cases. Welty [4] has elevated a wide strip of palatal mucosa after median incision. Ashley [5] described a procedure in which a mucoperiosteal flap was taken from the palate and the anterior portion, denuded of mucosa, used to plug the opening. At times it is necessary to devise a procedure to meet the particular conditions of the case.

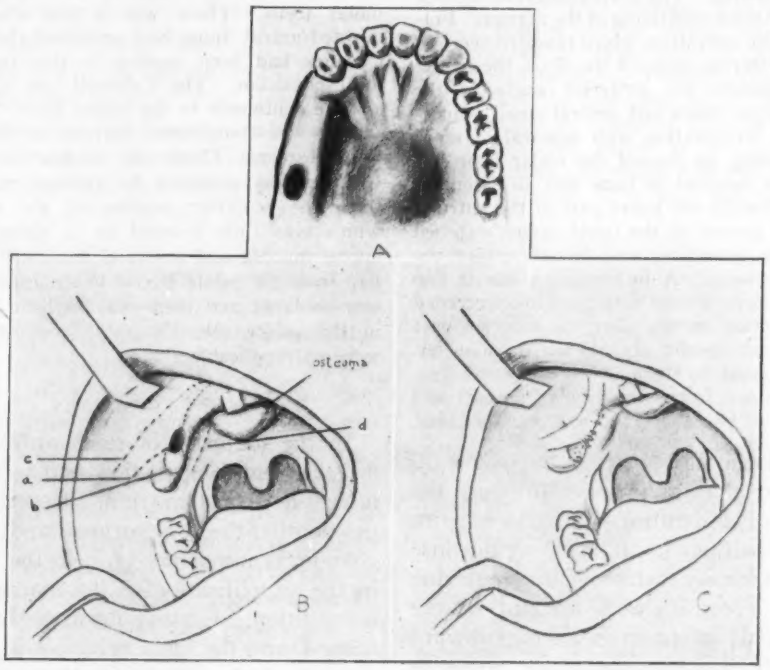

Fig. 4.—*A*, large alveolar fistula. Its treatment was complicated by the presence of the large osteoma (exostosis) in the palate. *B*, incisions used to close the fistula shown in *A*: (*a*) first incision; soft parts over the canine fossa to allow operative approach to the antrum; (*b*) hinged (reversed) flap to be turned up to close the weak posterior angle and provide a raw surface for a buccolabial flap; (*c*) incision for the sliding buccolabial flap; (*d*) incision for a narrow palatal flap. *C*, closure of the fistula shown in *A* and *B*. The hinged flap has been reversed and turned up to provide a raw surface for the buccolabial flap, which is then brought down over this, meeting the narrow palatal flap. The buccal incision is loosely approximated.

Even small fistulas, if of long duration, are best managed by operation on the canine fossa. Chronic sinusitis is always present, and complete control of the antral floor is essential.

C. P., aged 37, had a small fistula, just admitting a probe. It was a result of the extraction of a first molar tooth, ten years before. A roentgenogram suggested a large cyst in the floor, almost filling the antrum. Operation disclosed a large pedunculated polyp in the antrum coming from the nasal wall just anterior to the ostium. The fistula healed promptly after a Caldwell-Luc operation combined with removal of the fistulous lining and closure by mobilizing palatal mucosa after a median incision.

Chronic sinusitis may be accompanied by osteomyelitis of the alveolar process or of the antral wall. Infection, wherever located, must be thoroughly eradicated. Failure in this means failure in closure and necessitates a secondary operation.

K. T., aged 22, had a fistula of eight months' duration following extraction of a first molar tooth. The tooth had been pushed entirely into the antrum and later was removed through the fistula. Following a Caldwell-Luc operation and plastic procedure, the fistula apparently healed, but six weeks later it broke down. Reoperation revealed considerable osteomyelitis remaining in the process and in the antral floor. Final healing resulted only after thorough removal of necrotic bone and closure of the defect with a pedicle flap from the palate.

When there is extensive involvement of bone not only in the floor but in the outer wall of the antrum, the problem may be complicated further by an operative defect more difficult to close than the original fistula. One may find one has exchanged an alveolar fistula for a large opening

4. Welty, C. F.: Closure of Fistulous Openings Through the Alveolar Process into the Antrum of Highmore, Tr. Sect. Laryng., Otol. & Rhin., A. M. A., 1920, p. 198.

5. Ashley, R. E.: Method of Closing Antro-Alveolar Fistulae, Tr. Am. Laryng., Rhin. & Otol. Soc. 45:440, 1939.

through the canine fossa. The delayed flap, as suggested by New,[6] is especially adaptable for closing most of these defects. After elevation of the flap from the buccal mucosa it is sutured back in place to allow improved blood supply. A week later the flap is sutured over the defect. Sometimes a sliding flap of buccal mucosa with the blood supply at both ends intact may prove effective. When this can be used, it is a great time saver. Thorough removal of infected bone is essential. Reoperation may be necessary.

Mrs. A. A., aged 45, had been in poor general health for some time although general physical examination and serologic study of the blood gave negative results. The upper molar teeth were missing, and there was a small antroalveolar fistula. The roentgenogram showed chronic sinusitis with thickened lining of the antrum. Following a Caldwell-Luc operation, which revealed necrotic bone at the outer posterior angle of the floor, the fistula healed, but subsequently the posterior angle of the operative incision broke down and several small sequestrums came away. Reoperation with removal of more necrotic bone extending up toward the malar bone left a large defect. The removal of bone was so extensive as practically to obliterate the lower part of the antrum, so that the inferior meatus of the nasal cavity, exposed in the Caldwell-Luc operation, was directly under the defect in the canine fossa. A little later a buccal flap was brought down to cover the defect. This succeeded in closing the posterior portion, but the anterior part broke down, leaving an opening about 5 mm. in diameter. This was finally closed by turning up a hinged (reversed) flap of mucosa from the alveolar process and using a sliding flap of buccal mucosa to cover this area.

In an edentulous patient it is important to preserve sufficient alveolar process to insure the satisfactory use of a denture. This is a point rarely, if ever, mentioned. It is of significance when there is extensive osteomyelitis requiring the sacrifice of a considerable amount of the alveolar process. If attention is directed toward saving the tuberosity which forms the posterior buttress of the alveolar process, a denture can be made to fit quite efficiently.

C. L., aged 40, had a large fistula of two years' duration following the extraction of all his teeth. There was a foul discharge from the antrum. The Caldwell-Luc operation was combined with a plastic closure of the fistula by elevation of a large palatal flap. There was a good deal of osteomyelitis in the alveolar process and the antral floor, necessitating removal of considerable bone. The fistula closed, but the operative incision broke down. There was a foul discharge. The culture showed staphylococci. The infection in the antrum was treated locally with sulfathiazole powder. After two weeks the discharge had disappeared and the infection appeared to be controlled. There was an opening 2.5 cm. in length in the canine fossa. The margins were incised and elevated. Some of the alveolar plate was removed to allow better approximation, but care was taken to preserve the posterior buttress. A hinged (reversed) flap of mucosa was then turned up from the posterior part of the alveolar process and sutured with catgut to close the weak posterior angle. A fairly wide sliding flap of buccal mucosa was then brought down and sutured in place, with closure of the defect, leaving sufficient alveolar process to maintain a denture.

Frequently with a large fistula it is necessary to modify the technic to suit the particular demands of the individual case.

Mrs. B. B., aged 58, had a large fistula of two months' duration, following extraction of the upper molar teeth. There was a foul discharge, and the infected antral lining had prolapsed through the fistula. Caustics had been applied to this repeatedly by her local physician. The Caldwell-Luc operation revealed a large dehiscence in the antral floor. The plastic procedure was complicated because of the presence of a large osteoma filling the midportion of the palate. Closure was achieved by turning up a hinged flap from the posterior portion of the alveolar process, which was then covered by a sliding flap from the buccal mucosa and a second necessarily narrow sliding flap from the palate lateral to the osteoma. The defect was so large and there was so little available mucosa in the palate that the more conventional prcoedures were not applicable.

SUMMARY

In the majority of cases antroalveolar fistula follows dental extraction and is complicated by infection of the antrum. Cooperation between the dentist, the oral surgeon and the rhinolaryngologist is important both in the prevention and in the simplification of the management of such a condition. Gravity drainage is the prevailing hazard, and the main principle in management is control of the sinus infection. Early attention aimed at providing intranasal drainage may result in spontaneous healing, or this may occur in response to simple methods of closure. Cases of long duration require eradication of chronic antral infection and of any osteomyelitis. The Caldwell-Luc operation should be combined with plastic procedures designed to meet existing conditions. Secondary plastic operations may be required to close defects of the canine fossa in cases of extensive involvement of bone. No single technic is adaptable for all conditions. In an edentulous patient care should be exercised to preserve sufficient alveolar process to allow for a well fitting denture.

6. New, G. B.: Use of the Delayed Flap in Secondary Operations on the Palate and Antrum, Tr. Am. Laryng., Rhin. & Otol. Soc. **29**:344, 1923.

AN OTOLARYNGOLOGIC ASPECT OF FRONTAL MENINGOCELE

REPORT OF CASES

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While reviewing the literature on mucocele of the frontal sinus I was impressed by the frequent mention of frontal meningocele in the differential diagnosis of that condition. My interest in the subject was further stimulated when, during the aforementioned investigation, a baby was presented at the Royal Victoria Hospital with midline frontal meningocele and pronounced widening of the interorbital space. The child has a good chance of reaching adolescence or adult life without surgical intervention. The condition might then be mistaken for mucocele of the frontal sinuses. Because of this possibility of mistaking frontal meningocele for mucocele, the frequency of occurrence of frontal meningocele was considered. My neurosurgical colleagues at the Montreal Neurological Institute were consulted and on their suggestion the hospital records were reviewed to determine the number of cases in which this lesion has come under their supervision.

In addition to the case which I observed only 3 cases have been found by a review of the files of the Royal Victoria Hospital and the Montreal Neurological Institute. It would therefore appear that meningocele in the frontal region is rare. In 2 of the 3 cases just mentioned it resulted from congenital abnormalities and in 1 it was of traumatic origin.

Each of these earlier cases differs in certain respects from the others and from the case which I observed. For this reason they will be briefly reported with a view to pointing out their more relevant features.

REPORT OF CASES

CASE 1 (Frontal Meningocele; Spina Bifida).—The patient was a well nourished boy born in the Royal Victoria Hospital in February 1935. After eight days he died from meningitis. Dr. W. V. Cone examined the body and observed that there was early hydrocephalus, cranium bifidum with simple frontal meningocele and spina bifida of the rachischitic type with the spinal cord exposed (fig. 1). The anterior fontanel was about normal in size. The posterior fontanel was widely open. There was paralysis of the bladder and of the rectal sphincters. Dr. Cone was of the opinion that some obstruction was present between the ventricular and the cerebrospinal fluid pathways. He observed that touching the exposed cord produced motor responses in the legs. The sac of this spinal meningocele had ruptured, and the cerebrospinal fluid was escaping.

CASE 2 (Cranium Bifidum with Meningocele; Cleft Palate; Harelip).—The patient was a premature boy born one month before term in May 1928. He was admitted to the Royal Victoria Hospital in September 1928 because he had difficulty in holding a nipple in his mouth and in breathing through his nose. He had harelip and cleft palate at birth. The mother had noticed a mass protruding into the mouth through the cleft in the palate. The child was well nourished for a premature infant, and his general health was considered to be good. The anterior and posterior fontanels were normal in size; the eyes were widely separated; the nose was flat; the palate was cleft forward to the alveolar ridge; no teeth had erupted; a smooth globular mass protruded into the mouth throughout the length of the palatine cleft. The amount of oral space occupied by this mass is difficult to determine from the records, but that it was appreciable is suggested by the report that the mass was cystic and could be pushed into the cleft by the finger. The condition was diagnosed as meningocele. The harelip was repaired in September 1928, and the meningocele was kept under observation. In January 1929 the child was admitted to the Montreal Neurological Institute because the meningocele was occupying a considerable amount of the oral space and the patient was unable to breathe

Fig. 1 (case 1).—Frontal meningocele and spina bifida in a newborn boy.

From the Department of Otolaryngology, Royal Victoria Hospital.

through the nose (fig. 2). His general condition was good. Air was injected through the anterior fontanel, and subsequent roentgenograms demonstrated that the mass in question was a meningocele passing through a defect near the junction of the frontal and ethmoid bones. An attempt was made to close this defect by Dr. Wilder Penfield, but the child succumbed to the operation. At operation a defect in the base of the skull was noted through which an encephalomeningocele passed downward to become attached to the membrane which constituted the roof of the mouth. There was a definite bony edge to this defect anteriorly and laterally but not posteriorly. The carotid arteries emerged into the cranial cavity close to the edge of the defect. The optic chiasma was not seen. The defect was circular, about 3.5 cm. in diameter. The sac of the meningocele extended through the nose and the nasopharynx to project visibly into the mouth.

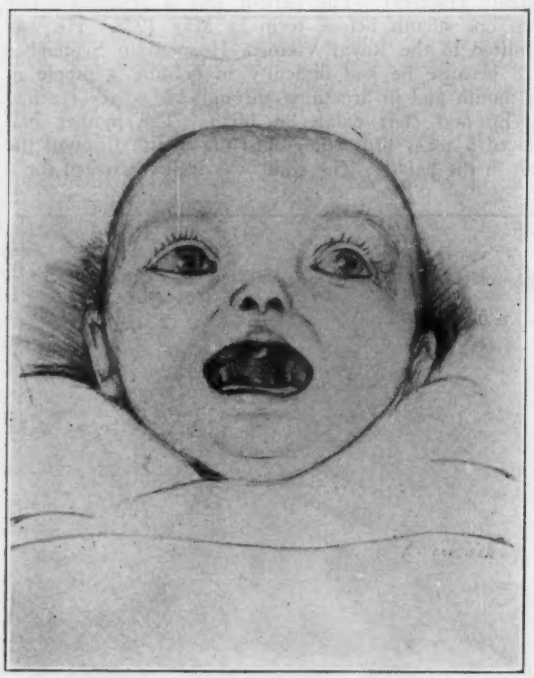

Fig. 2 (case 2).—A drawing to illustrate a meningocele presenting through a cleft palate. Widening of the interorbital space is to be noted.

I recognize in reporting this anomaly that it is more an ethmoidal than a true frontal meningocele. Herniating through the cribriform plate rather than through the metopic suture it caused such changes in the nose and the mouth that its inclusion in this series is felt to be justified.

Case 3 (Post-Traumatic Frontal Meningocele).—The patient was a boy 10 months old, who was admitted to the department of ophthalmology of the Royal Victoria Hospital in May 1930. He was normal at birth. When he was 6 months old, his face was injured by snow falling from a roof. Considerable swelling of the face resulted but cleared up readily except for that of the right upper eyelid, which persisted and varied in size from time to time. It was on account of this swelling that the child was admitted to the hospital. A cystic mass could be palpated through the skin of the right upper eyelid. Its size was not definitely recorded. It was removed by Dr. J. A. MacMillan through an incision in the outer half of the right upper eyelid immediately below the eyebrow. It was approached in this way under the assumption that it was a post-traumatic cyst. The mass was readily exposed and easily freed except where it was firmly attached posteriorly to the medial surface of the orbit. It was thought that the sac might be adherent posteriorly to the dura. The cyst wall was white and smooth and poorly vascularized. The cyst was opened and found to be full of clear fluid. This was considered to be cerebrospinal fluid, but when no further fluid escaped even on jugular compression, any communication with the subarachnoid space was doubted. The cyst wall was excised posteriorly, and the wound was closed. One week after the operation the wound opened, and for four days cerebrospinal fluid escaped. This was arrested by pressure bandages, and recovery was immediate. The cyst wall when examined in histologic sections was observed to be composed of heavy collagen fibers in parallel order. A few unaltered blood vessels were reported. No inflammatory or proliferating tissue was present.

The final opinion was that this constituted a post-traumatic meningocele.

The boy is now 13 years of age and is well developed. The surgical scar over the right eye is inconspicuous. The left eye is normal. Vision in the right eye is 6/36 and is not improved by glasses. Dr. K. B. Johnston, of the department of ophthalmology, reported on Sept. 14, 1943 that he had been unable to find any cause for the poor vision.

Case 4 (Frontal Meningocele).—A boy aged 11 months was examined by me in the department of otolaryngology at the Royal Victoria Hospital on Feb. 5, 1943. He was brought to the hospital because of a swelling of the forehead which had been present since birth. The mother stated that this swelling had gradually increased in size and that it enlarged considerably when the child cried. The child was normal in other respects. There was no history of familial disease.

A soft swelling was seen above the glabella, separating the orbits, which measured about 2.5 cm. in diameter (fig. 3). Palpation revealed fluctuation of the swelling and a defect in the underlying frontal bone. When the child was at rest, a slight pulsation, synchronous with the pulse, was visible over the swelling. When he cried, the swelling increased in size. The skin overlying the swelling was healthy. The ears, the nose and the throat were essentially normal. A diagnosis of frontal meningocele was made, and roentgenograms of the skull were taken and interpreted as follows by Dr. A. E. Childe, of the Montreal Neurological Institute.

"The anterior fontanel is still rather widely open, but the skull is not increased in size, and there is no separation of the sutures. The orbits are separated more than normally superiorly, and their superior and medial margins run more obliquely than is normal. There is a defect between these two portions of the orbits, measuring 2.5 cm. in width by 1.5 cm. in height, continuous with the metopic suture (fig. 4 *A*). A picture similar to this is found in "The Head and Neck in Roentgen Diagnosis," by Pancoast, Pendergrass and Schaeffer.[1] The cribriform plate, particularly its anterior portion, is poorly defined (fig. 4 *B*), and it is

1. Pancoast, H. K.; Pendergrass, E. P., and Schaeffer, J. P.: The Head and Neck in Roentgen Diagnosis, Springfield, Ill., Charles C Thomas, Publisher, 1940, p. 76.

probable that the medial portions of the superior orbital plates are also poorly developed. No abnormality of the sella turcica is shown, and the skull is otherwise not unusual in appearance. The impression is that of frontal meningocele associated with separation of the orbits and defective development of the cribriform plate and portions of the superior orbital plates. There is no definite evidence of hydrocephalus."

The patient was examined in the neurosurgical clinic by Dr. W. V. Cone and Dr. A. R. Elvidge. They confirmed the previous clinical findings and the diagnosis.

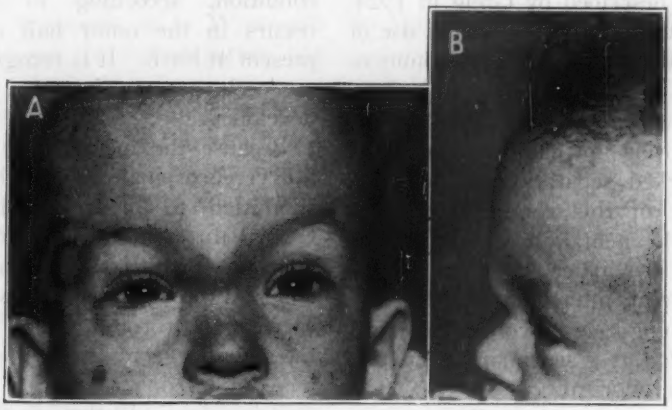

Fig. 3 (case 4).—*A*, midfrontal swelling above the glabella with unusually wide interorbital space in a boy aged 11 months. *B*, anterior projection of the midfrontal swelling.

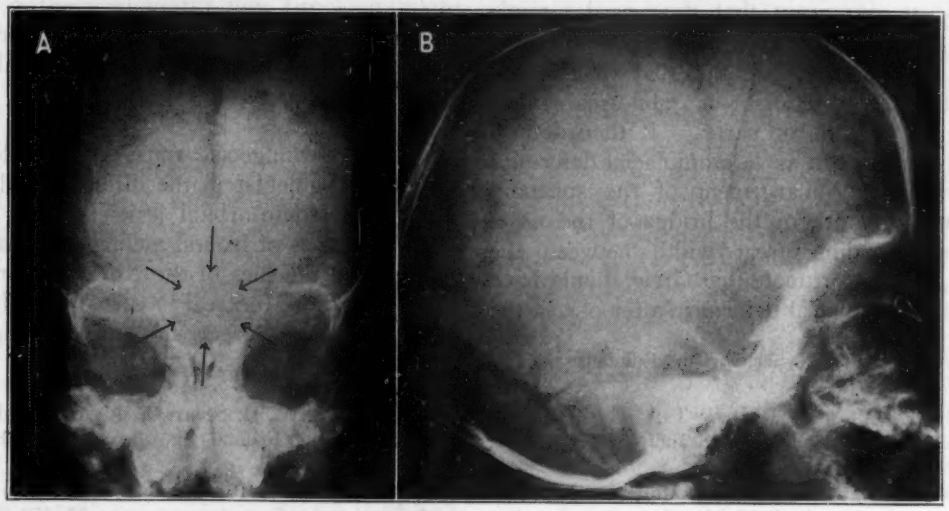

Fig. 4 (case 4).—*A*, meningocele of the frontal bone. The defect is in the midline, and the orbits are separated in their superior halves more than is normal. *B*, lateral view showing the defect in the anterior part of the frontal bone extending down to the nasal bones (retouched). There is also a partial defect of the cribriform plate and of portions of both superior orbital plates.

They reported the skull to be symmetric and not markedly enlarged, the anterior fontanel under no undue tension and the results of neurologic examination negative.

This patient is developing well without any special treatment. That he may reach adult life is a reasonable expectation. He will be watched as carefully as circumstances permit. It will be interesting to see whether or not frontal sinuses develop.

COMMENT

Frontal meningocele is rarely encountered, but it must be considered in the differential diagnosis of the various fronto-orbital conditions for which patients may seek advice and on which the otolaryngologist will be expected to pass judgment. It is recognized that frontal meningocele is usually congenital in origin and therefore precedes any development of the frontal sinuses. Case 3 illustrates the possibility of the meningocele occurring as a result of trauma. It is therefore impossible to rule out frontal meningocele simply because the lesion in question has occurred after birth. One must also consider that a patient with a small meningocele may seek medical advice in adolescence or during

adult life when the difficulties of diagnosis could be greater than they were in the cases reported in this article. This situation may yet arise in case 4, because the expectancy of the child reaching adult life is good.

There was marked widening of the interorbital space in cases 2 and 4. This conditon has been represented in medical literature by the term "hypertelorism" but that usage has been criticized on the ground that the term is applicable only to a condition described by Greig in 1924. Because of the confusion as to the proper use of this term, I am including the following comment on it in this article.

"Hypertelorism" was apparently introduced as a medical term by Greig [2] to name a craniofacial deformity with marked separation of the eyes. The primary cause of this condition he considered to be a developmental abnormality of the sphenoid bone. In the article cited he specifically stated that great interocular distance in cases of frontal meningocele or congenital facial cleft is to be regarded as a secondary phenomenon and not as hypertelorism.

Bojlén and Brems [3] reviewed the literature on hypertelorism in 1938. They claimed that "hypertelorism" had been used descriptively in 42 cases since Greig coined the term, and that in only 27 of these cases was the term properly used. It is significant that they used Greig's name in their title.

"The American Illustrated Medical Dictionary" defines hypertelorism as "abnormal width between two organs or parts." It then defines ocular hypertelorism as "a craniofacial deformity characterized by enlargement of the sphenoid bone, great breadth of the bridge of the nose, with corresponding great width between the eyes." [4] It is unfortunate that Greig should have named his craniofacial deformity after one of the essential features of the condition. It would be less confusing to state that hypertelorism occurs in the condition which Greig described and that it also occurs with frontal meningocele in some cases.

As pointed out by various authors,[5] a congenital condition which must be differentiated from meningocele and mucocele of the frontal sinus is epidermoid cyst or, as it is sometimes called, cholesteatoma of the frontal sinus. This condition, according to Garretson,[6] usually occurs in the outer half of the orbit and is present at birth. It is recognized that the frontal mucocele occurs after the frontal sinuses have developed.

Because the meningocele communicates with the cerebrospinal fluid pathways, it cannot be submitted to biopsy, aspirated or otherwise treated through contaminated fields without the operator's courting the danger of meningitis. Surgical procedures for its treatment must be carried out through clean fields, preferably by the neurosurgeon, from whose province the lesion has wandered.

It is a medical aphorism that mistakes in diagnosis are due more to omissions than to commissions. Modern advances in medical science have not altered the truth of this statement. In keeping with this thought it can be said that the otolaryngologist will rarely be confronted with frontal meningocele, but because it does occur he must keep it in his diagnostic cerebral center.

SUMMARY

Frontal meningocele must be considered by the otolaryngologist in the differential diagnosis of various fronto-orbital lesions.

Only 4 cases of frontal meningocele have been recorded in the files of the Royal Victoria Hospital and the Montreal Neurological Institute. In each of these cases treatment was sought during the first year of life.

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6. Garretson, W. T.: Mucocele of the Frontal Sinus with Report of a Case, Laryngoscope **37**:350-354 (May) 1927.

PRIMARY TUMORS OF STENSEN'S AND WHARTON'S DUCTS

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AND
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Tumor arising in Stensen's or in Wharton's duct is rare. A review of the literature has failed to reveal any reports of a tumor primary in either of these situations. In all probability the condition is not as unusual as this fact might indicate, however, for one fairly frequently encounters in the floor of the mouth a malignant neoplasm that is too far advanced to permit of recognition of the site of origin. Two cases of adenocarcinoma of the main salivary ducts have come under our observation in recent years. In addition two inflammatory nodules occurring without associated salivary calculi have been encountered in these structures. Clinically the latter nodules were indistinguishable from true neoplasms.

The symptoms complained of in the cases of true neoplasm were not uniform. In one case they were those characteristic of recurring obstruction of Stensen's duct. Sudden pain with tenderness and swelling in the parotid region was induced by eating and lasted for a few minutes to several hours, terminating spontaneously with abrupt subsidence of the discomfort and enlargement, accompanied by a gush of saliva into the mouth and a foul taste. Repeated recurrence of these symptoms took place in this case and also in another in which an inflammatory nodule was present in the parotid duct. After the symptoms had recurred with increasing frequency during the course of several months in the former case, the patient, who was a physician, discovered a hard, painless nodule in the cheek. This was assumed to be a calculus. In the other case of adenocarcinoma of Wharton's duct, the patient, also a physician, had noted two small, tender nodules in the right side of the floor of the mouth situated anteriorly along the course of the submaxillary salivary duct. These had increased steadily in size but had not produced evidence of obstruction to the flow of saliva.

In the differential diagnosis of tumors of this type a salivary calculus lodged in Stensen's or in Wharton's duct is the principal consideration. On palpation their consistency is indistinguishable from that of a calculus, and the possibility of a calculus being present and accounting for the findings can be excluded only by means of roentgenograms made with large dental films inside the mouth. A stone of even slight density would stand out well in a film exposed in this manner, so that a roentgenogram not showing a pronounced shadow should immediately suggest the possibility of a neoplasm.

The tumors in these cases were firm, movable, tender, slow-growing nodules, and each appeared to be encapsulated within the wall of the duct, so that they were relatively easy to remove. Histologic study was necessary for definite recognition, and excision was carried out for this purpose as well as for therapeutic reasons.

While the patients were under local anesthesia induced with procaine hydrochloride, the tumors were exposed through an incision in the oral mucous membrane, and each appeared as a firm, well localized enlargement of the salivary duct. In the cases of adenocarcinoma, the tumors were excised, the duct being amputated, and in one of the cases the proximal stump of the duct was inserted into a stab wound in the cheek posterior to the site of the original orifice. Interstitial radium therapy was given in the operative wounds. Both of the two distinct nodules present in the submaxillary salivary duct in the second case proved to be malignant.

In the cases of inflammatory nodule, there was associated parotitis, and a small amount of mucopus could be expressed from the orifice of Stensen's duct. Thick, mucinous secretion was pent up posterior to the nodule in the duct in each of these cases. In fact, external drainage had been required recently in one of the cases, and a draining sinus in the parotid region was present at the time of our examination. As each nodule was incised for biopsy, a good deal of mucopurulent material escaped from the duct. Calculi were not demonstrable in either nodule. One of the nodules was excised and the wound packed with iodoform gauze. In the other case the nodule was not removed, but a gauze pack

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was inserted into the dilated duct. The nodule completely absorbed within a few weeks, and the parotid infection cleared promptly in both instances.

REPORT OF CASES

CASE 1.—A 62 year old white man, a physician, came to the Mayo Clinic on Aug. 25, 1941 with a complaint of sudden onset of pain in the left cheek three months previously while he was eating. This was followed almost immediately by swelling below the left ear. A few hours later these symptoms subsided spontaneously. This occurrence was repeated numerous times in the ensuing three months, occurring steadily more frequently with the beginning of meals, persisting for a short time following the meal and suddenly subsiding with a gush of saliva and a disagreeable taste in the mouth. Palpation of a nodule in Stensen's duct on the left side and dilatation of the duct itself brought the patient in for diagnosis.

Examination revealed a nodular tumor in the buccal mucosa, about 0.5 cm. in diameter, just posterior to the orifice of the duct. The nodule was hard, movable and somewhat tender. Clear mucinous secretion could be expressed from the duct. While the patient was under local anesthesia, Stensen's duct was exposed, and the tumor, which was found to be encapsulated and which completely encircled the duct, was excised. The duct was severed well back of the lesion and its proximal end brought out through a stab wound in the buccal mucosa posterior to the site of the original orifice. Examination by a pathologist revealed adenocarcinoma, grade 1 (Broders' method). Interstitial radium therapy was applied to the operative field. There has not been any recurrence of the cancerous process.

CASE 2.—A 55 year old white man, a physician, entered the clinic on July 8, 1935. He had noted two small, firm, tender nodules in the anterior portion of the floor of the mouth on the right side for two months. These had grown slightly but had not produced obstruction to the submaxillary salivary duct.

Examination revealed two smooth, firm nodules, each approximately 0.5 cm. in diameter, in the anterior portion of Wharton's duct on the right side. These were excised while the patient was under local anesthesia.

The duct posterior to the growths was moderately dilated with mucopus. The wound was cauterized and packed wide open, and eight radon seeds, totaling 4 millicuries, were inserted. The patient later received roentgen therapy externally. Microscopic examination showed the nodules to be adenocarcinoma, grade 1. The patient has not been heard from since the foregoing treatment was carried out. It is assumed that he has not experienced any further trouble in this regard.

CASE 3.—A 52 year old white man entered the clinic on Sept. 21, 1935 with a complaint of soreness and swelling of his left cheek for twenty-four hours. A firm, tender, movable tumor, 1 cm. in diameter, could be palpated just posterior to the meatus of Stensen's duct on the left side. The patient had not noted this previously. The duct posterior to the nodule was dilated, and the parotid gland was acutely tender, edematous and indurated. The patient was treated conservatively until the acute phase had passed. Roentgenograms did not show any evidence of a calculus, and the nodule, which involved and obstructed the duct, was excised. It appeared inflammatory grossly and proved to be of this nature on microscopic examination. The patient was seen five years later and had not had any further difficulty.

CASE 4.—A 37 year old white man entered the clinic on Nov. 7, 1935 with a history of recurrent painful swelling of the left parotid region for two years. The swelling occurred rapidly, without warning, and subsided spontaneously a few hours later. Two weeks prior to admission to the clinic the mass had been incised anteriad to the left ear. Examination disclosed a firm nodule, 0.5 cm. in diameter, in Stensen's duct on the left side, 2 cm. posterior to the meatus. The parotid gland was edematous and tender and presented a draining fistula just anterior to the ear.

The nodule was excised from the wall of the duct, releasing considerable pus posteriorly. The wound was packed wide open. Microscopically the tumor was observed to be only inflammatory hyperplastic tissue. The patient has not reported further difficulty.

THE PREEPIGLOTTIC SPACE

ITS RELATION TO CARCINOMA OF THE EPIGLOTTIS

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Laryngologists long have recognized that the thyroid cartilage, a hyaline structure, which commonly exhibits ossification in adult life, is an effective barrier against anterior invasion by a cancer of a vocal cord. Perforation of the cartilage may occur late in the disease but then it usually is associated with pyogenic infection. Cancer occurring in other parts of the larynx commonly extends more rapidly beyond its primary site. One of the reasons is absence of an effective limiting barrier. The extension of cancer therefore is not dependent entirely on histologic structure and lymphatic drainage but also on tissue barriers.

The anterior part of the supraglottic larynx corresponding to the lower one half of the epiglottis and the anterior extremity of a ventricular band is the second most common site of laryngeal cancer. This usually is referred to as vestibular cancer. In this area it is prone to invade anteriorly as well as to extend along a ventricular band. Attention was directed to this in 1940 [1] after several cases of recurrence of cancer in the region of the hyoid bone following laryngectomy had been observed.

It was believed that the lymphatic drainage from the anterior part of the vestibule reached lymph nodes in the region of the body of the hyoid bone. Subsequent investigations have convinced me that the unfavorable results obtained in certain of my early cases of vestibular cancer were not due to metastasis to regional lymph nodes but to early invasion of an area, the preepiglottic space, which is devoid of an effective limiting barrier on its posterior boundary. The importance of this space was not recognized.

Although Orton [2] and New [3] long had advocated removal of the hyoid bone in laryngectomy they did this originally to facilitate closure of the pharyngeal stoma. Robert [4] and Bisi [5] directed attention to the preepiglottic space, the part it played in the anterior extension of vestibular cancer and the importance of its surgical extirpation for the successful treatment of cancer in this location.

The preepiglottic space is described by anatomists as triangular or funnel shaped in sagittal section, with the base directed upward (fig. 1 *A*). It is an actual space, filled with cellular and adipose tissue; it contains no lymph nodes but is traversed by lymphatic vessels. The anterior and anterolateral walls are formed by the upper portions of the wings of the thyroid cartilage and thyrohyoid membrane. This membrane is strengthened by elastic fibers in the midline and at the tips of the greater cornua of the hyoid bone, forming the median and lateral thyrohyoid ligaments. It is pierced on each side of the midline by the superior laryngeal vessels and the internal division of the superior laryngeal nerve and also transmits a few efferent lymphatic vessels. The base is closed by the hypoepiglottic aponeurosis or ligament which extends from the upper margin of the body of the hyoid bone to the anterior surface of approximately the middle of the epiglottis and corresponds to the bottom of the vallecula. The posterior boundary is formed by the epiglottis extending from the hyoepiglottic aponeurosis above to the thyroepiglottic ligament, which is situated immediately above the anterior commissure. Since the lower part of the epiglottis becomes narrowed the remainder of the posterior boundary of the preepiglottic space is formed by an elastic membrane. This can therefore be considered as the weak wall of the preepiglottic space, as the epiglottis itself affords little protecton against cancerous invasion since it consists of thin yellow

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This paper was presented before the meeting of the American Laryngological, Rhinological and Otological Society, in New York, June 10, 1944.

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elastic cartilage which exhibits many depressions, even perforations, and rarely undergoes ossification (fig. 1 *B*).

In dissecting a number of specimens of the larynx following their extirpation for cancer of the base of the epiglottis and vestibule I have been impressed with the fact that the growth always was extensive and its presence unquestionably antedated by months the duration of the clinical symptoms. Although the exact primary origin of an extensive vestibular cancer cannot always be determined, it did not appear to originate in the midline, and involvement of the anterior extremity of one vestibular band always occurred. Occasionally it extended a considerable distance along one ventricular band and often involved the anterior end of the opposite band but to a lesser degree (fig. 2 *A*).

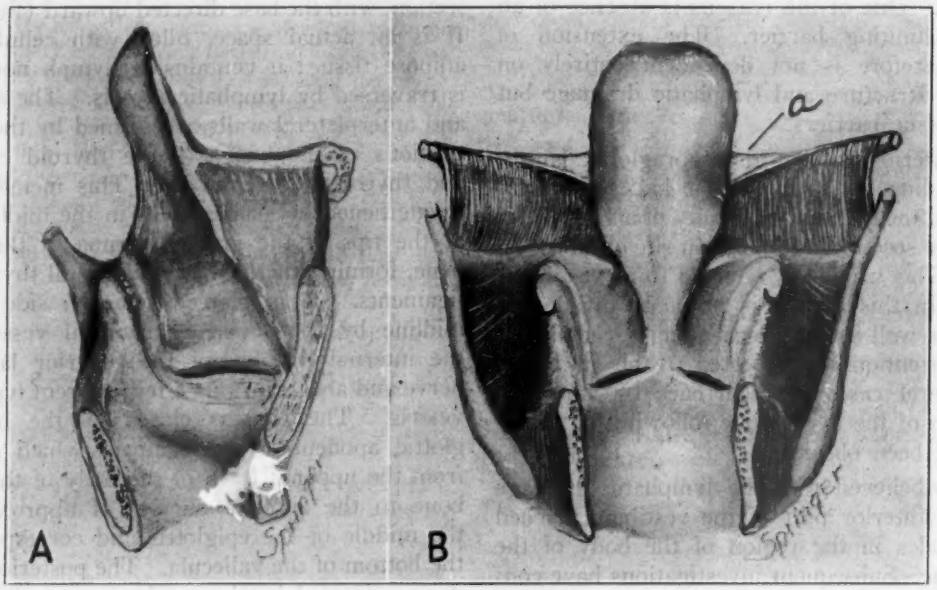

Fig. 1.—*A*, sagittal section of the larynx showing the preepiglottic space and its boundaries. The thyrohyoid membrane and the thyroid cartilage are anterior. The hypoepiglottic aponeurosis above forms the base and the epiglottis and the thyroepiglottic ligament are posterior.

B, schematic drawing to show the defective or weak posterior wall of the preepiglottic space, which is formed by the epiglottis from the level of the hypoepiglottic aponeurosis (*a*) above to the thyroepiglottic ligament below. The lateral margins are closed by elastic membrane.

Involvement of the vocal cords is uncommon except in the very extensive lesions. Robert [4] found that the lower limit of the growth always is above a horizontal plane passing through the anterior commissure and the bottom of the ventricle.

The anterior invasion of the preepiglottic space is important, for it cannot be determined by mirror laryngoscopy or by direct examination (fig. 2 *B*). While much information can be secured by lateral roentgenograms of the larynx, these commonly exhibit only the more dense portions of the cancer. It is common to find cancer cells by microscopic examination in the preepiglottic space well beyond the apparent anatomic margins of the growth. The thyrohyoid membrane and the hyoepiglottic aponeurosis offer marked resistance to neoplastic invasion, so that in cases of preepiglottic invasion involvement of the base of the tongue or penetration of the thyrohyoid membrane to the front of the neck is rare. There commonly is metastasis to the regional lymph nodes long before this occurs.

The lymphatic drainage from the base of the epiglottis and the anterior extremities of the ventricular bands is carried across the preepiglottic space through the thyrohyoid membrane to the upper nodes of the deep cervical group. Occasionally, one or more vessels pass upward and terminate in a node situated below the posterior belly of the digastric muscle, but metastasis to this is uncommon. In 2 recent cases of carcinoma of the base of the epiglottis I discovered small nodes immediately above the hyoid bone on the mylohyoid muscle. These apparently were submental nodes which, usually arranged in transverse direction, occasionally may be vertically placed and then one is in close relation to the hyoid bone. In these 2 cases the position of the submental nodes apparently conformed to the latter arrangement. In neither of these was there any histologic evidence of carcinoma.

Since carcinoma of the anterior portion of the larynx above the vocal cords invariably perforates the epiglottis and commonly invades the preepiglottic space before it is recognized clinically, it is necessary to deal surgically with this space (fig. 2*C*). Invasion through the hyoepiglottic aponeurosis is rarely observed; therefore a surgical approach which does not enter the preepiglottic space should be employed. If one removes the hyoid bone with the larynx by incision through the muscles above it and keeps the operation above the hyoepiglottic aponeurosis the incision always is through normal tissue. Laryngectomy with extirpation of the preepiglottic space, or preepiglotto laryngectomy (Bisi [5]), would seem to be the rational surgical procedure to practice in all these cases.

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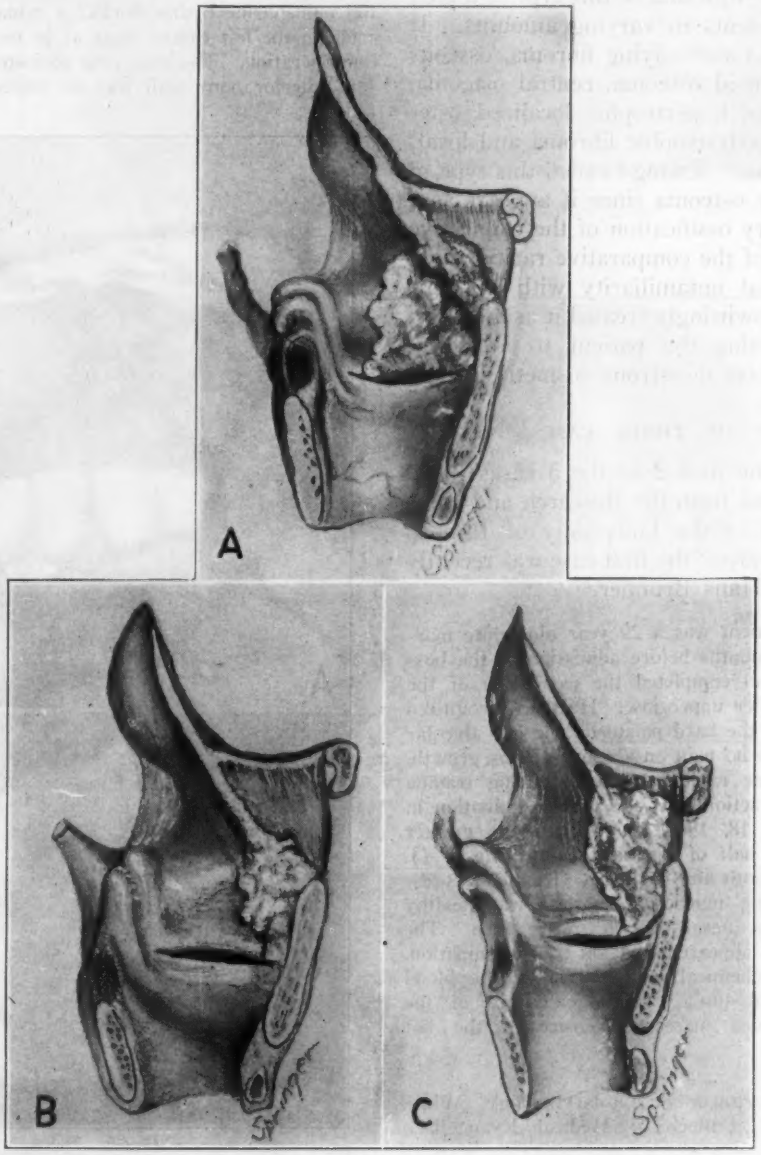

Fig. 2.—*A*, extensive cancer of the vestibule which extended a considerable distance along the left ventricular band, crossed the anterior commissure and involved the anterior end of the right ventricular band. The lower two thirds of the posterior surface of the epiglottis also was involved. Invasion of the preepiglottic space was widespread but had not penetrated deeply.

B, cancer of the vestibule of the larynx which involved the extreme anterior ends of both ventricular bands. There were no disturbances of the voice. Although the epiglottic involvement was extensive, it could not be visualized by mirror laryngoscopy because of an overhanging epiglottis. Invasion of the preepiglottic space extended to the median thyrohyoid ligament.

C, extensive invasion of the preepiglottic space by a vestibular cancer which exhibited a relatively small surface lesion. Because of the close proximity of the invading mass to the hyoepiglottic aponeurosis, incision across the preepiglottic space would have resulted in incomplete removal of the cancer.

OSSIFYING FIBROMA OF THE SUPERIOR MAXILLA

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Ossifying fibroma is a rare benign tumor of nondental origin. Fibroma of this type is mixed with osseous elements in varying amounts. It has been described as ossifying fibroma, osseous fibroma, fibro-osteoid osteoma, central osteoma, sclerosing fibroma, hypertrophic localized osteitis, localized osteodystrophic fibroma and localized osteitis fibrosa.[1] Ewing [2] called this type of growth secondary osteoma since it appears as a result of secondary ossification of the connective tissue. Because of the comparative rarity of the tumor and clinical unfamiliarity with it, some observers have unwittingly treated it as a cancer, needlessly subjecting the patient to a radical resection, often with disastrous cosmetic results.

REPORT OF THREE CASES

The data on the first 2 of the 3 cases to be reported originated from the Research and Educational Hospital of the University of Illinois.

A histologic study of the first case was recently reported by Dr. Hans Brunner.[3]

CASE 1.—The patient was a 29 year old white married woman. Six months before admission to the hospital her dentist had completed the extraction of the remaining teeth in her upper jaw. He then recognized a small swelling in the hard palate on the left alveolar margin. There was no pain on account of this growth. The swelling became rapidly larger following trauma incident to the extraction. At the first examination in the hospital, Nov. 18, 1940, it occupied the greater portion of the left half of the hard palate (fig. 1 *A*). The tumor was smooth and hard, not yielding on pressure. The overlying mucous membrane was healthy in appearance. The nasal passages were open. The left maxillary sinus appeared dark on transillumination. The results of a chemical examination of the blood were within normal limits. Roentgenograms of the nasal sinuses showed increased density of the left antrum.

Operation and Course.—With the region under anesthesia induced by infiltration of procaine hydrochloride and epinephrine hydrochloride, a sublabial incision was made in the left canine fossa as in the usual Caldwell-Luc operation. The overlying periosteum was elevated. The anterior bony wall was no thicker than a cigaret paper. Beneath this thin bony jacket there was a hard, well circumscribed, creamy-colored tumor completely filling the lumen of the antrum. Owing to the size of the growth, considerable difficulty was encountered in its mass extraction. Finally, the posterior limb of

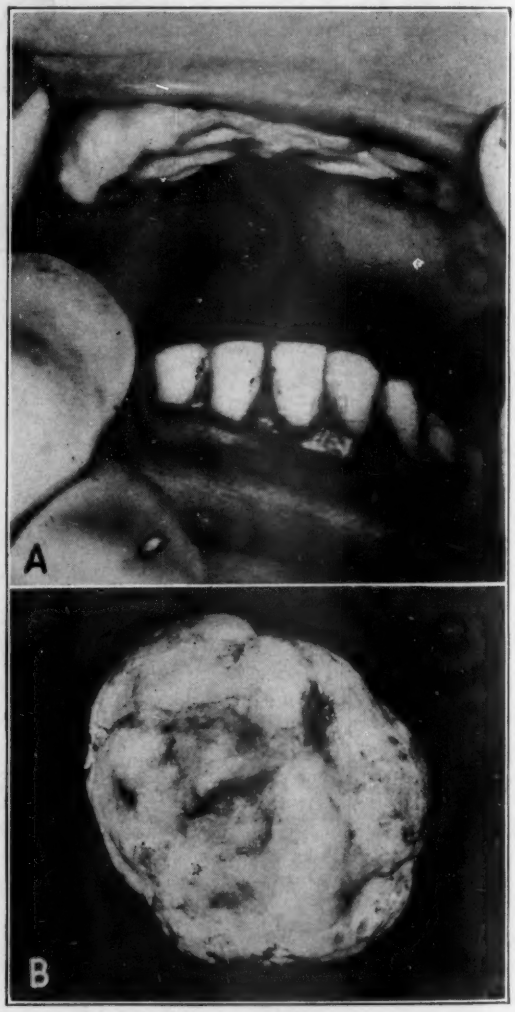

Fig. 1 (case 1).—*A*, appearance of the growth on the hard palate when the patient was admitted to the hospital. *B*, tumor. Its actual measurements were 3 by 4 by 5 cm.

From the Department of Otolaryngology, White Memorial Hospital, College of Medical Evangelists, Los Angeles.

Permission to report the 2 cases was obtained from Dr. A. R. Hollender, the acting head of the department of otolaryngology.

1. Thoma, K. H.: Oral Pathology, St. Louis, C. V. Mosby Company, 1943; Clinical Pathology of the Jaws, Springfield, Ill., Charles C Thomas, Publisher, 1934.

2. Ewing, J.: Neoplastic Diseases, ed. 4, Philadelphia, W. B. Saunders Company, 1940.

3. Brunner, H.: Nasopharyngeal Fibroma, Ann. Otol., Rhin. & Laryng. **51**:29-65 (March) 1942.

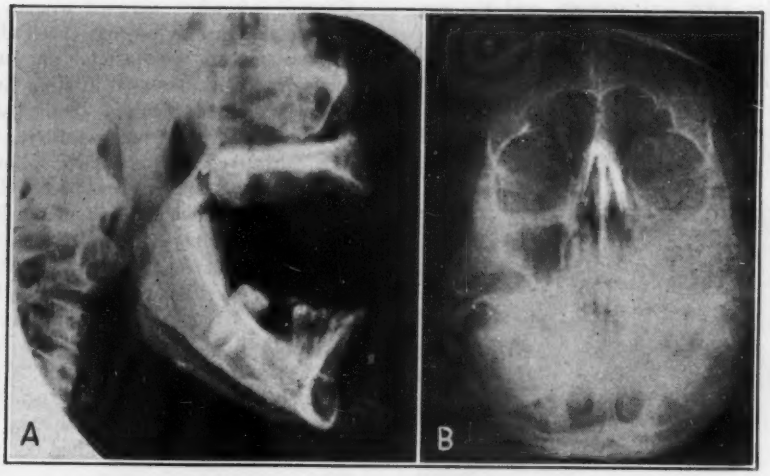

Fig. 2 (case 1).—*A*, roentgenogram showing the smooth outline of the tumor. This ruled out cancer. *B*, roentgenogram showing increased density of the left maxillary sinus.

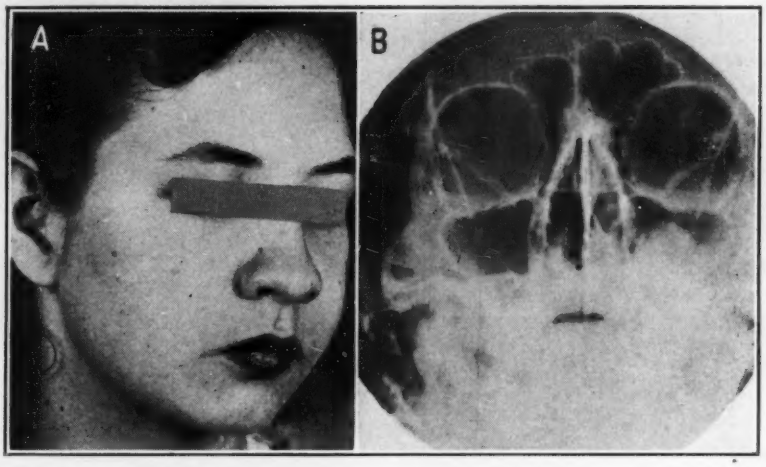

Fig. 3 (case 2).—*A*, patient with slight suggestion of prominence of the left cheek. *B*, roentgenogram showing a clearly circumscribed globular mass in the left maxillary sinus.

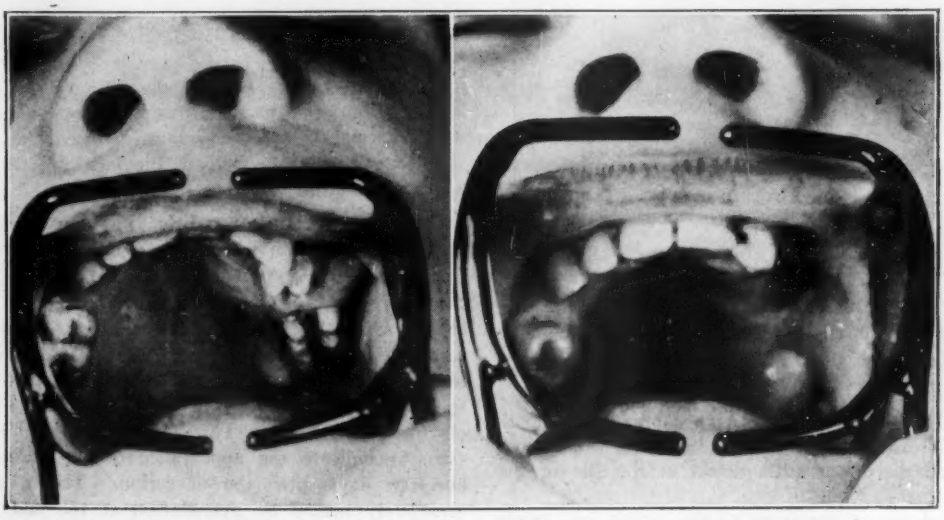

Fig. 4 (case 2).—Appearance of the site of the growth before and ten days after the operation. The operative defect was completely filled by granulation tissue within three weeks.

the superior alveolar arch was severed, and the egg-shaped tumor was shelled out from its attachment. A small area in the superior alveolar arch was necrosed. Curettement was continued until healthy bone was encountered. The incision was closed with silk. The defect in the wound was left to heal by granulation. The tumor weighed 45 Gm. and measured 3 by 4 by 5 cm. (fig. 1 *B*). Her postoperative course was smooth and she was dismissed in ten days. Subsequent examination showed there was little defect at the site of the operation.

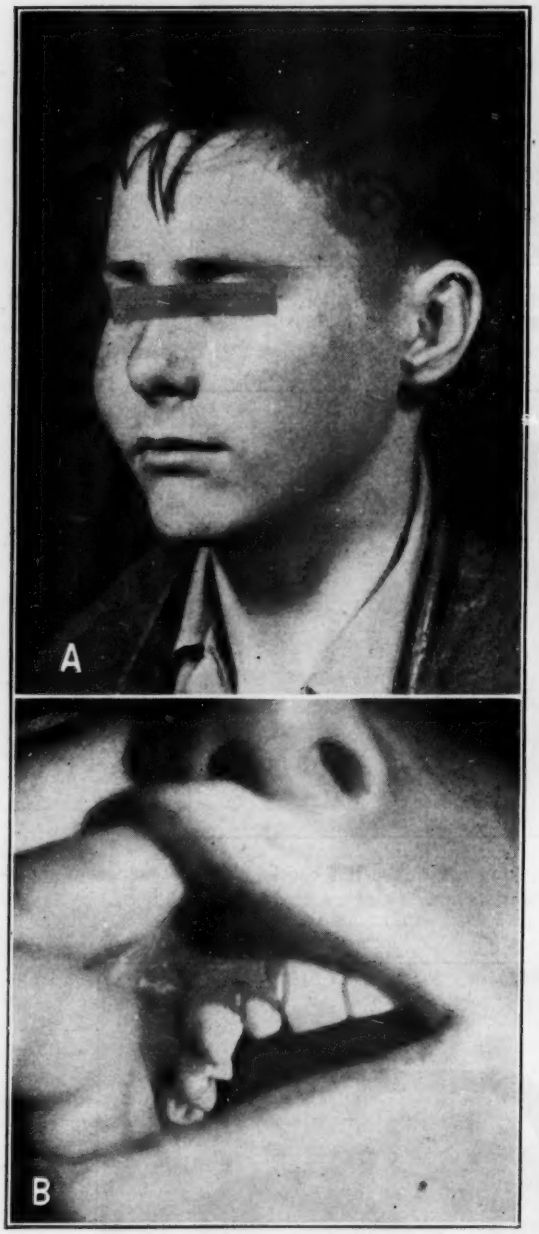

Fig. 5 (case 3).—*A*, patient showing distinct prominence of the right cheek. *B*, teeth irregularly set over the tumor.

The histologic examination of the tumor was made by Dr. W. O. Brown. His diagnosis was ossifying fibroma.

Case 2.—A white married woman of 20 years first noticed a swelling of her left cheek about a year before her admission to the hospital on July 1, 1942. The growth gradually increased in size. In March 1942 her left upper second bicuspid tooth had been extracted on account of vague but persistent toothache in this region. She received no relief following this extraction. There was no history of facial trauma. At the time of her first examination in the hospital there was a globular mass about the size of a golf ball on the anterolateral surface of the left superior maxilla. The dome-shaped swelling projected equally into the buccal and the oral aspects. The canine fossa was completely obliterated. The growth extended well into the alveolar process as far forward as the lateral incisor tooth and posteriorly to the entire molar region. It was smooth on the surface and hard on palpation. It was slightly tender on pressure. It smoothed out the left labionasal fold but caused no marked disfigurement (fig. 3 *A*). The calcium and phosphorous contents of the blood were normal. Roentgenograms showed a rounded shadow in the lower half of the left superior maxilla (fig. 3 *B*).

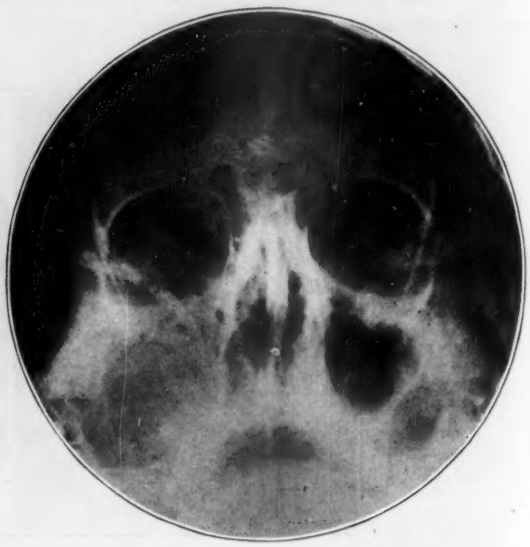

Fig. 6 (case 3).—Roentgenogram showing increased density of the right superior maxilla. The upper part of the sinus contains air. Note the third molar tooth within the tumor.

Operation and Course.—July 1 a biopsy was taken, and on July 9, with the patient under ether anesthesia, the tumor was exposed through an opening in the canine fossa. The entire mass, including a portion of the floor of the antrum, was removed. The growth was homogeneous and creamy colored, not unlike cartilage in appearance and consistency. The patient responded well to postoperative care and was dismissed on the twelfth day. The accompanying photographs (fig. 4) indicate the appearance of the palate before and ten days after the operation. The wound was completely healed by granulation at the end of three weeks.

The histologic diagnosis was ossifying fibroma.

CASE 3.—The patient was a well developed, healthy 14 year old white boy. His clavicle was fractured at the age of 2 and again at the age of 5, both times from falls. There was no history of facial injury. Nine months before admission to the White Memorial Hospital in Los Angeles he noticed a progressive swelling of the right upper jaw extending upward from the alveolar ridge, along the canine tooth as far back as the posterior limit of the second molar tooth (fig. 5*A*). The growth was about the size of a pigeon's egg at the time the patient came under my observation on March 2, 1942. It was smooth and round, occupying practically the entire anterolateral aspect of the superior maxilla. The greatest bulge was in the canine fossa, causing slight facial asymmetry (fig. 5*B*). His teeth were set irregularly and were crowded. The nasal passages were free. The Wassermann reaction of the blood was negative, and the hemograms were normal. There was no abnormality in the chemical composition of the blood. The roentgenograms of the paranasal sinuses indicated diffuse density over the lower half of the right maxillary sinus. There was no inflammatory change in the sinal lining, and the roentgenograms were suggestive of an expanding new growth (fig. 6).

Operation and Course.—March 12, with the region under anesthesia induced by infiltration with procaine hydrochloride and epinephrine hydrochloride, an inverted T incision was made over the right canine fossa. The periosteum was thin. Beneath it the growth had occupied the entire width of the lateral aspect of the antral wall. The tumor encroached on the lumen of the sinal cavity but it had invaded neither the orbital floor nor the posterior limit of the lateral wall. The growth was bitten away piece by piece. It was fairly vascular. Its color was creamy yellow. In curetting the growth the operator noted that the sensation was not unlike that of cutting deep into a raw potato. An unerupted third molar tooth was found deep in the tumor. The growth had infiltrated the roots of the bicuspid teeth and all the molar teeth, but no effort was made to curet this area. The wound was closed with ten day catgut. The postoperative course in the hospital was uneventful, and the patient was dismissed on the sixth day.

The histologic examination of the tumor was made by Drs. E. G. Hoxie and R. H. Osborne. Their diagnosis was ossifying fibroma.

The advisability of instituting radiotherapy for the unresected portion of the growth was discussed with those in charge of the tumor clinic. The radiologists felt that in view of the age of the patient the possible danger to his teeth might outweigh the benefit from such treatment. He was last seen June 9. There was definite regression of the growth. He failed to respond to a follow-up letter sent in January 1944.

REVIEW OF THE LITERATURE AND COMMENT

In 1927 Montgomery [4] collected 14 cases of ossifying fibroma of the jaw from the literature. In 5 of these the upper jaw was involved. Four of the patients were women between the ages 20 and 22 years. The fifth patient was a boy 11 years of age. Montgomery added 3 cases of his own. In 2 of these the superior maxilla was involved. The patients were men aged 62 and 69, respectively.

A most comprehensive study was made by Phemister and Grimson [5] in 1937. There were 13 cases in their series, in 4 of which the tumor occurred in the superior maxilla. In 1 case both the superior and the inferior maxilla were involved. The 5 patients were under 29 years of age. The youngest was 11. This article reviewed detailed reports of 30 cases from sixteen sources. In 24 of these cases the growth began between the ages of 8 and 32. The oldest patient was 54. In 19 cases the tumor involved one side of the superior maxilla; in 7 cases the body of the inferior maxilla was invaded. In another the tumor had invaded the superior and inferior maxilla, on the same side. Furedi [6] recorded 14 cases of osteofibroma of the superior maxilla from the clinical records of the New York Institute of Clinical Oral Pathology. Nine of the patients were women and 5 were men; their ages ranged from 25 to 65. In 1 instance the tumor invaded both sides of the superior maxilla. Geschickter and Copeland [7] collected 30 cases from the records of the Johns Hopkins Hospital; two thirds of the patients were under 30 years of age. Harris and Hagaman [8] reported 3 cases. All the patients were Negroes. Two were women aged 33 and 41, respectively. The third was a boy 12 years of age. Kato [9] reported ossifying fibroma in a Japanese man aged 20. The tumor had developed after a trauma of the face occurring two years before the operation. He cited four other Japanese authors. Ash [10] gave an excellent description of the growth removed from a white youth aged 16 by Hall. Hellner [11] described an ossifying fibroma in a woman 28 years of age. Complete resection was performed by Professor Eischoff. The tumor

4. Montgomery, A. H.: Ossifying Fibroma of the Jaw, Arch. Surg. **15**:30-44 (July) 1927.

5. Phemister, D. B., and Grimson, K. S.: Fibrous Osteoma of the Jaw, Ann. Surg. **105**:564-583 (April) 1937.

6. Furedi, A.: Study of Osteofibroma of the Maxilla, Dent. Cosmos **77**:1004 (Oct.) 1935.

7. Geschickter, C. F., and Copeland, M. M.: Tumors of the Bone, ed. 2, New York, American Journal of Cancer, 1936.

8. Harris, R., and Hagaman, V.: Ossifying Fibroma of the Upper Jaw, Ann. Otol., Rhin. & Laryng. **51**: 508-515 (June) 1942.

9. Kato, M.: Ossifying Fibroma of the Superior Maxilla, Oto-rhino-laryng. **14**:323 (May) 1941.

10. Ash, J. E.: Dental and Oral Pathology, Chicago, American Dental Association, 1940.

11. Hellner, H.: Die Formen der Ostitis fibrosa des Kiefers, Arch. f. klin. Chir. **165**:229-281, 1931.

was first noticed in the patient's nineteenth year. Jentzer [12] recorded a case. The patient was a man 37 years of age. Four years before admission he had a carious tooth extracted from the left superior maxilla. A growth developed at the site, which later required surgical extirpation.

GENESIS OF THE TUMOR

Ossifying fibroma develops in the spongiosa. The exact mode of its origin is not definitely known. Phemister and Grimson stated that the growth is a true neoplasm and not a form of trauma as a predisposing factor. Harris and Hagaman expressed the belief that growths of this type represent a developmental cell derangement of the dental periosteum incident to the completion of the permanent tooth cycle in the deciduous teeth. Eden [13] expressed the view that this type of tumor is the result of a disturbance of growth. It occurs most frequently during the period of adolescence, when the bony development is most active.

Embryologically, the jaws develop from the membranous bone. There are three centers of

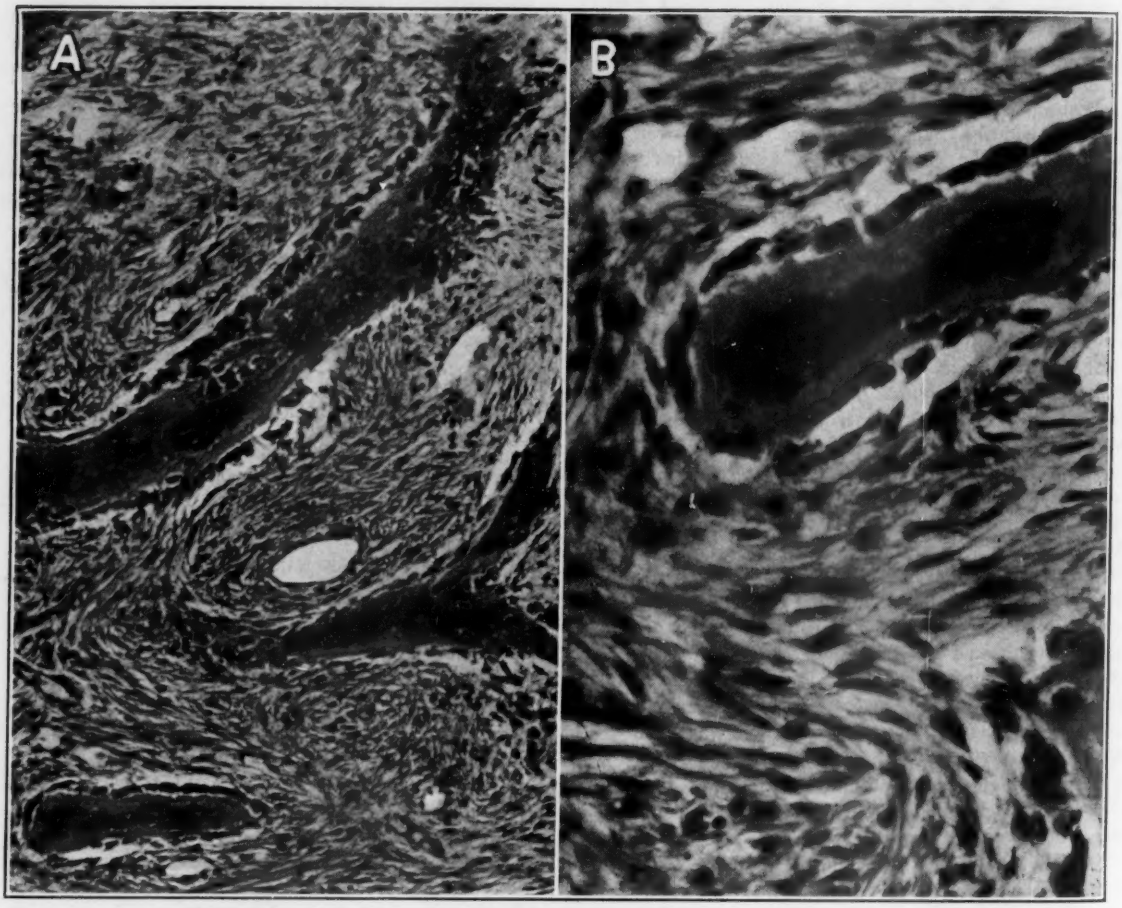

Fig. 7.—*A*, abnormal bony trabeculae, thin and irregular, in a stroma of abnormal connective tissue. Note rows of osteoblasts surrounding the bony trabeculae. These osteoblasts are actively depositing new bone. *B*, higher magnification of a portion of *A*.

osteitis fibrosa, hyperostosis or chronic inflammation. A bacterial origin may be discounted since in a large number of instances both the tumor and the adjacent structures are free from chronic inflammatory change.

A number of writers have noted an association with carious teeth. Others have mentioned facial ossification within the superior maxilla. The embryonic connective tissue is transformed into bony structure without undergoing an intermediary cartilaginous transition like that of the long bones. According to Geschickter and Copeland a predisposition for tumor formation is present not only at each stage of transition from one form of tissue to another but also on every

12. Jentzer, A.: Ostéofibrome douloureux du maxillaire supérieur gauche; echec du traitement médical; opération modelante; résultat clinique et esthétique, Schweiz. med. Wchnschr. **65**:101-103 (Jan. 26) 1935.

13. Eden, K. C.: Benign Fibro-Osseous Tumors of the Skull and Facial Bones, Brit. J. Surg. **27**:323-350 (Oct.) 1939.

phase of development. In the largest number of cases the tumor is found between the ages of 20 and 30. The absence of disturbance in the metabolism of the calcium and the phosphorus in the blood, as shown by Klassen and Curtis,[14] indicates that the disease has no relation to osteitis fibrosa of von Recklinghausen. Hence the term "localized osteitis fibrosa" is a misnomer, and Thoma aptly calls the tumor fibro-osteoma and ossifying fibroma.

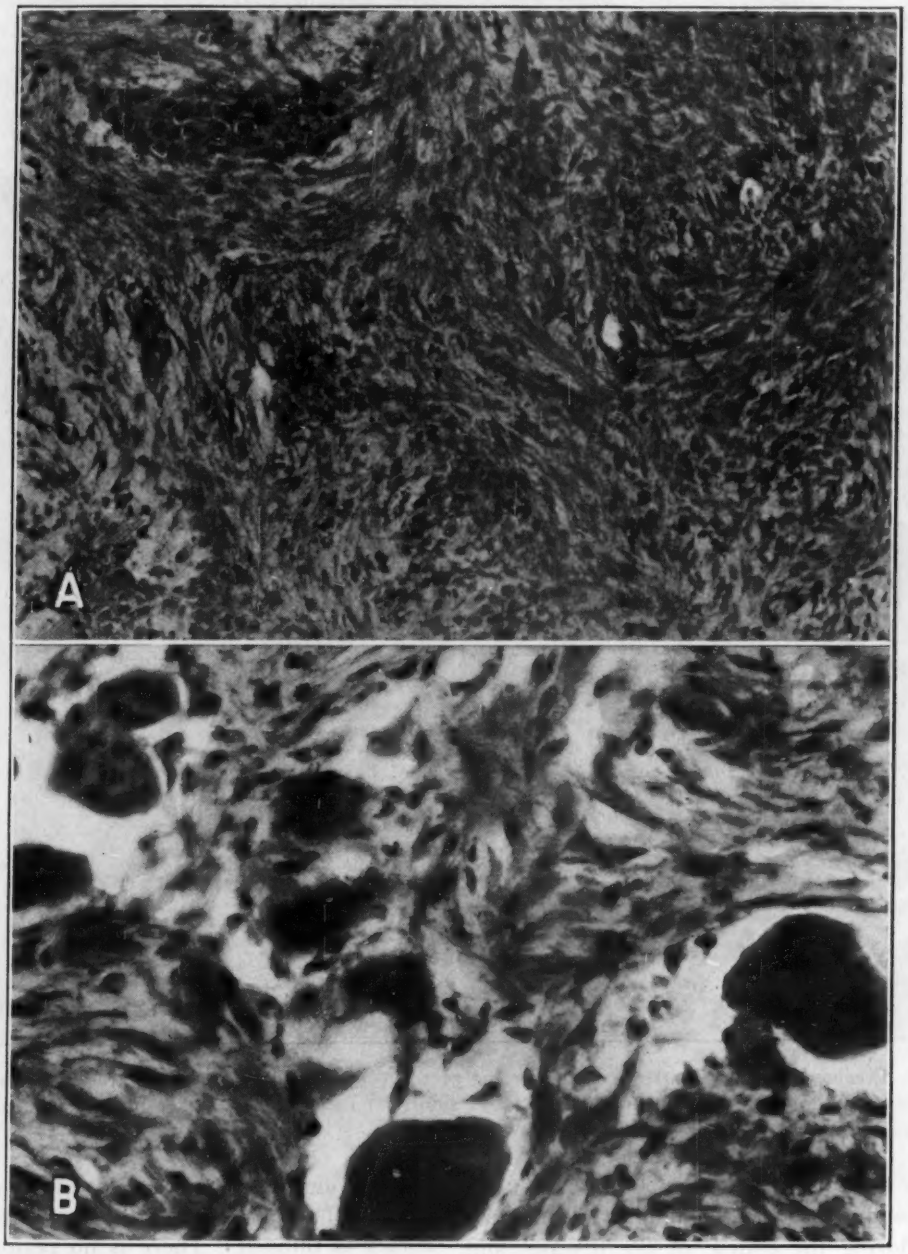

Fig. 8.—*A*, newly formed osteoid trabecula (upper left) and young connective tissue (lower right). A zone of transition is well shown. *B*, giant osteoclasts. These are numerous where absorption of bone has recently been completed.

SYMPTOMS AND PHYSICAL SIGNS

The disease occurs in women much more frequently than in men. The tumor grows slowly. It usually involves one side of the superior maxilla. In one group the site of predilection is in the anterolateral portion of the upper jaw, including the alveolar process. It eventually obliterates the canine fossa and may invade the adjacent portion of the malar bone. Its outward

14. Klassen, K. P., and Curtis, G. M.: Calcium and Phosphorus Metabolism in Ossifying Fibroma of the Mandible, J. Bone & Joint Surg. **21**:244-250 (Oct.) 1939.

expansion on the buccal surface results in a characteristic facial deformity. In the second group the tumor invades the hard palate, occasionally causing dysphagia.

The tumor shows no tendency to metastasize. No case has been recorded in which it became cancerous. The history is often unreliable in determining the duration of the growth, as the patient is unaware of its existence until there is a lump on the hard palate or a widening of the alveolar ridge. The overlying teeth may be healthy or they may be carious. They are usually irregular and crowded. A vague toothache may develop during the course of the disease, and an unsuspecting dentist may extract the supposedly aching tooth without affording the patient relief. The soft tissue over the growth is smooth and avascular, but the tumor feels hard and nonyielding on palpation. When advanced, the growth may occupy the entire cavity of the antrum. It may encroach on the floor of the orbit, causing narrowing of the palpebral opening or proptosis. There is no nasal obstruction. On transillumination the involved antrums appear dark.

ROENTGENOGRAPHIC DIAGNOSIS

Roentgen examination is a distinct aid in diagnosis. It helps in distinguishing the cancerous bone-forming tumor from the noncancerous one. The cancerous growth tends to infiltrate. The contour of the noncancerous tumor is always smooth. Roentgenologically two distinct types of ossifying fibroma may be recognized. They are (1) circumscribed or (2) diffuse in appearance. The maxilla is markedly enlarged. The cortex is thinned. There is no periosteal reaction. Depending on the age of the patient and on the amount of calcification, the tumor appears to vary from diffuse haziness to complete ashy density. According to Worth,[15] the growth occurring in the younger patient casts a homogeneous but soft shadow on the film, presenting a stippled appearance not unlike that of the rind

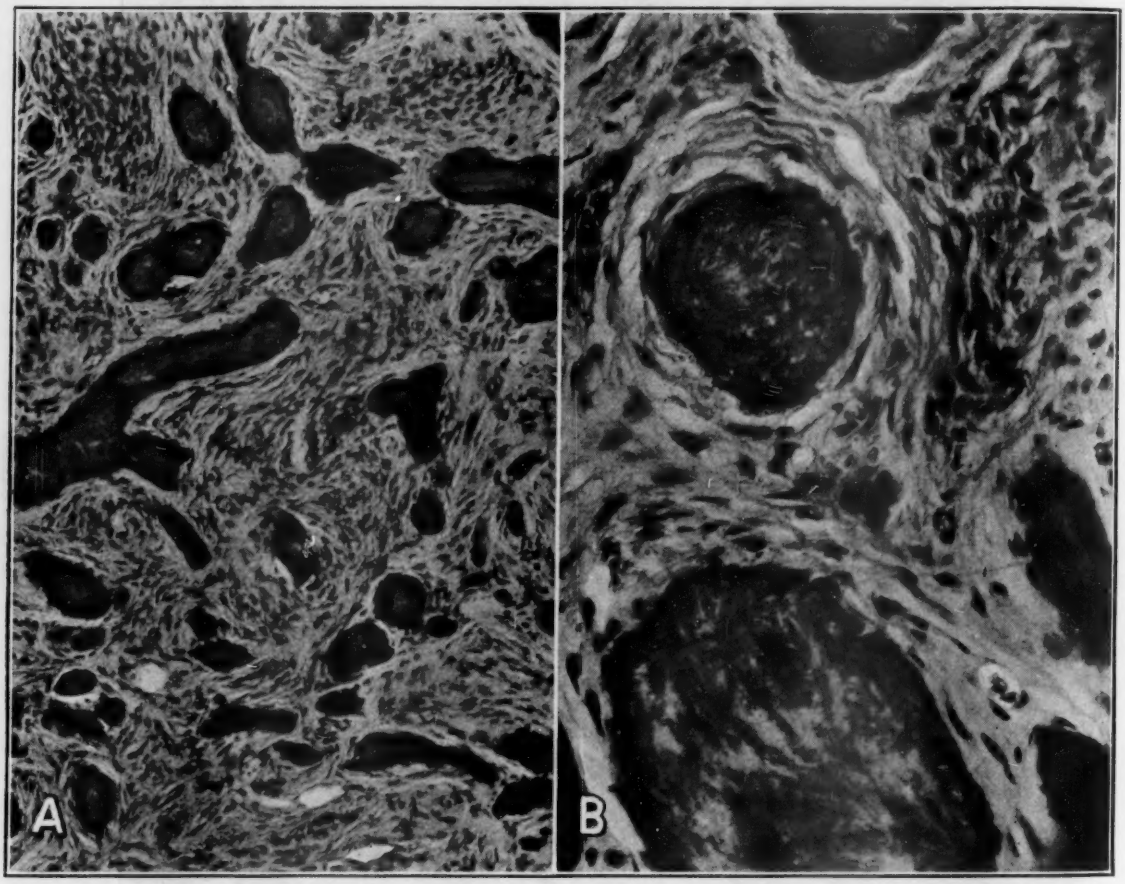

Fig. 9.—*A*, calcium deposits scattered in the stroma of the connective tissue. These are characteristic of the noncancerous tumor of the membranous bones of the skull and the face. *B*, higher magnification of a portion of *A*.

15. Worth, H. M.: Tumors of the Jaw, Brit. J. Radiol. **10**:223-236 (March) 1937.

of an orange. The lesion in the older patient usually casts a dense ground glass shadow and appears much harder and structureless. In all of the present series the lower half of the affected maxillary sinuses appeared diffusedly clouded.

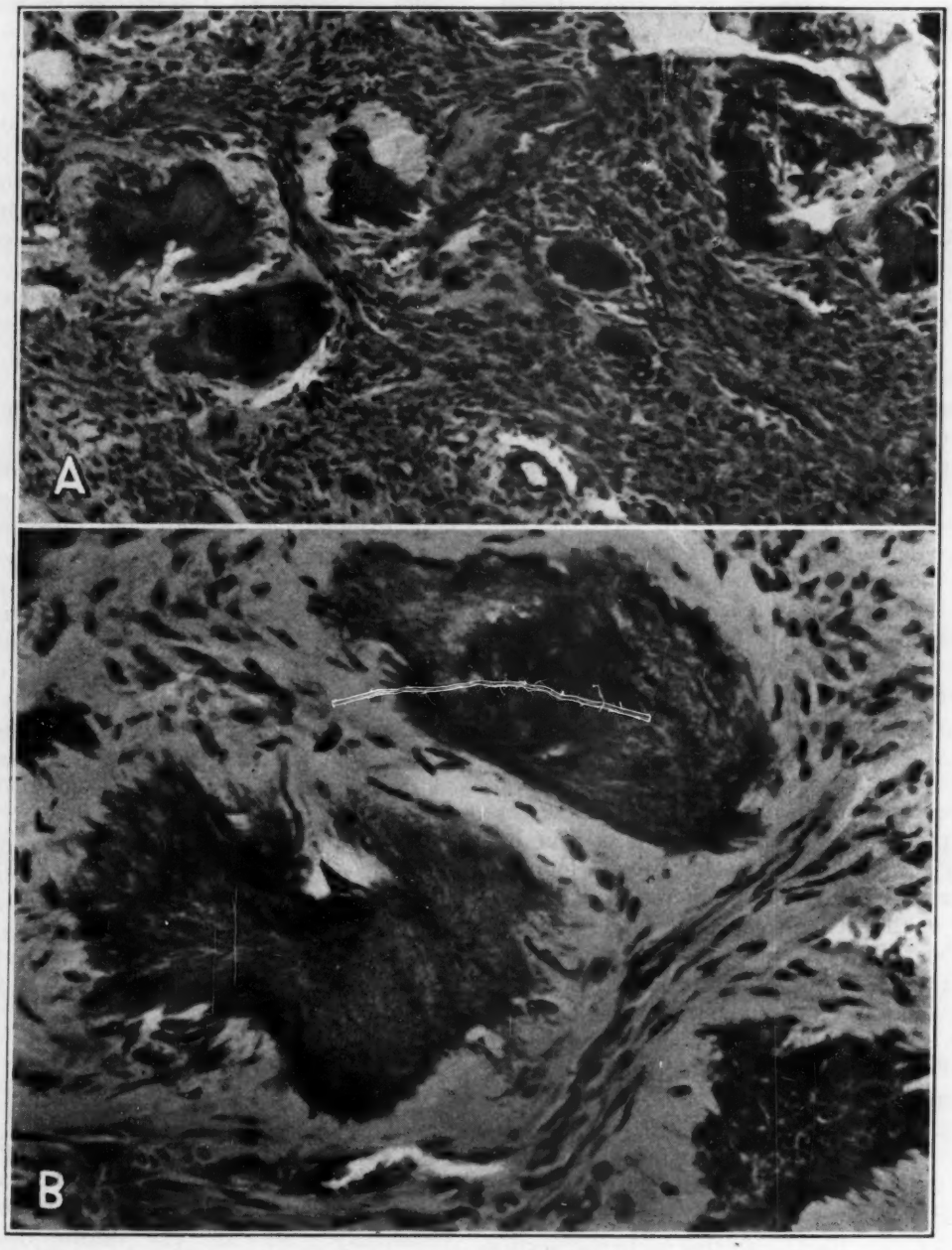

Fig. 10.—*A*, section showing evolution of calcium deposits in the whorl of connective tissue. The surrounding connective tissue is compressed by their expansion. *B*, higher magnification of a portion of *A*.

A small area of rarefaction above the site of the tumor suggested the presence of air. The mucosal lining was intact.

MACROSCOPIC AND MICROSCOPIC EXAMINATIONS

Macroscopically, the ossifying fibroma is soft yet firm at operation. The cutting knife gives the operating surgeon a sensation not unlike cutting into a raw potato. Some writers have compared the cutting resistance to that of hard soap. The tumor is moderately vascular. It has no distinct capsule. It is creamy in color and easily distinguished from the surrounding normal bone.

Histologically, the growth consists of abnormal bony trabeculae, thin and irregular, scattered in a stroma of abnormal connective tissue. The trabeculae are composed of osteoid tissue rather than of mature bone. The borders of these

trabeculae are deeply eosinophilic, but the centers of many retain some calcium, as evidenced by bluish staining. However, some of the thinner trabeculae are composed of osteoid tissue with no hint of calcification. The trabeculae vary in length and width. They are irregularly arranged. They are surrounded by rows of osteoblasts (fig. 7 *A* and *B*). In a few regions these osteoblasts have become elongated and spindle shaped. However, there are areas in which osteoblast layers are two or three cell layers in thickness. There is no normal bone marrow; the marrow spaces are filled in with compact connective tissue, which is arranged in whorl-like masses and in strands. Between its moderately thick collagen fibers are spindle-shaped cells with deeply staining nuclei. Some of these are plump, and others appear dense and elongated. There are a few areas where the tissue consists of a loose, irregular network of young connective tissue devoid of osteoid or bony structures. Where this type of tissue adjoins the osteoid tissue there is a clearcut transitional zone (fig. 8 *A*). In this zone one can trace developing trabeculae from their beginning in the eosinophilic stroma of the connective tissue. This zone has the appearance seen in the early stage of metaplastic bone formation such as may occur in a healing wound. There are a few scattered foci of giant cells of the type often seen in benign tumor of bone. They have the structure of giant osteoclasts (fig. 8 *B*). A few of these adjoin the osteoid trabeculae. Most of them lie in groups in fibrous areas. These perhaps represent foci where absorpton of bone has recently been terminated. They are not found in the areas of most active proliferation of osteoid tissue. In the section removed in case 2 there are a number of psammoma-like bodies which lie free on the stroma of the connective tissue. Their evolution can easily be traced (fig. 9 *A* and *B*). A small amount of pink-staining material, resembling collagen, is deposited in the center of a cellular whorl. It becomes the seat of calcium deposits. This later enlarges and becomes surrounded by a sheath of cells from expansion. Such calcium spheroids are usually located in quite cellular areas devoid of well formed bony trabeculae (fig. 10 *A*). In this particular section no bony trabeculae are present. According to Geschickter and Copeland, the spheroids are indicative of some derangement of early bone formation, and they are typical of ossifying tumors of the cranial bones, in which the calcium is deposited in globular masses independent of the process of ossification. There is no evidence of old or recent hemorrhage. The growth is moderately vascular. None of these specimens shows the exact junction of the normal bone. In most instances the tumors occurring in young patients are cellular while those developing in adults are composed of adult compact bone.

TREATMENT

Aaron [16] reported a case in which ossifying fibroma was successfully treated with a large dose of radiation. However, the treatment of choice is surgical removal. There are two schools of thought regarding the operative management: 1. There are those who believe that a complete resection of the involved area must be thoroughly carried out in order to prevent recurrence. They depend on a prosthesis to fill the operative defect when indicated. Some prefer to ligate the external carotid artery when extensive surgical work is contemplated. In the light of the present knowledge the circumscribed tumor is best treated by complete removal, as in the first 2 cases. 2. The so-called conservative school is best exemplified perhaps by Phemister and Thoma. These authors caution against sacrificing too large an area of the bony stucture. When the tumor involves the alveolar ridge it is curetted down to the dental roots, but the teeth are spared. In selected cases, small fractional doses of radiation may be given following the operation. In view of the noncancerous nature of the growth, such a plan would be adequate in most instances. The preferable method is that of careful excision of the growth with cauterization of the surrounding area. The operation is best performed during the period of quiescence. The patient should be seen at regular intervals after the operation. If the growth recurs, it must be reoperated on. According to Geschickter and Copeland, the incidence of recurrence is less than 15 per cent.

SUMMARY

Three tumors diagnosed as ossifying fibroma of the superior maxilla occurred in 2 women, aged 20 and 29, and a boy 14 years of age. Two of the tumors were well circumscribed; the third was diffuse. The circumscribed tumors were completely resected. The diffuse tumor was curetted sufficiently to give its bony bed a normal contour. No attempts were made to remove the portion which infiltrated the dental roots.

120 North Oak Street.

16. Aaron, I.: Ossifying Fibroma of the Maxillary Sinus, Am. J. Cancer **29**:551-555 (March) 1937.

HEMANGIOMA OF THE ADULT AND OF THE INFANT LARYNX

A REVIEW OF THE LITERATURE AND A REPORT OF TWO CASES

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The first report of a case of hemangioma of the larynx was made by Mackenzie [1] in 1864. Twenty-four years later Wolfenden [2] tabulated 11 cases from the literature and added a twelfth. Irwin Moore [3] found 68 cases in a survey of the literature up to 1923; in addition he recorded 8 cases of lymphangioma. Since that time, no survey has been reported.

In the present survey I have excluded 3 case reports, those of Nicolsky,[4] Resser [5] and Collet,[6] because the publications were not available. Also excluded are reports of lymphangioma and tumors classed as hemangioendothelioma or otherwise indicated as cancerous. I have been able to find 55 additional instances of laryngeal hemangioma in the literature to date to add to the 68 tabulated by Moore, making a total of 123. Included in this number are single cases reported by Wolf,[7] Penna,[8] Quix,[9] Jones,[10] Raaflaub,[11] Bernhardt,[12] Hückel,[13] Altrichter,[14] Kawai,[15] Berendes,[16] Suehs and Herbut [17] and Monteiro.[18] Hofmann [19] reported 2 instances of tracheal hemangioma of the infantile type, Kompanejetz [20] noted 4 cases of hemangioma of the adult type, Kramer and Yankauer [21] added 14 cases of this type while New and Erich [22] described 23 previously unreported cases.

CLASSIFICATION

Sweetser [23] was the first to separate the tumors into two classes: those rarer ones occurring in infants, and the more common type, seen in adults. He noted that hemangioma was located below the level of the vocal cords in infants, while it occurred on or above the vocal cords in adults. In 1940 Suehs and Herbut [17] reported the eighth case of hemangioma of the infantile larynx and reviewed the previous 7 cases.

DEFINITION

Most observers have excluded from their reports cases of hemangioma in which the larynx was secondarily invaded, the tumor taking origin from some contiguous structure. Fallas [24] and Levbarg [25] have reported such cases. While Suehs and Herbut included Levbarg's case in their report, both of the cases have been excluded

1. Mackenzie, M.: Essay on Growths in the Larynx, Philadelphia, Lindsay & Blakiston, 1871.
2. Wolfenden, R. N.: On Angiomata of the Larynx, J. Laryng. & Rhin. **2**:291, 1888.
3. Moore, I.: Further Remarks on Angeiomata of the Larynx, J. Laryng. & Otol. **38**:57 (Feb.) 1923.
4. Nicolsky, A.: Zur Frage der Kehlkopfangiomen, Russk. oto-laryng., 1924, no. 5-6, p. 332.
5. Resser, M.: Ein Fall von Larynxangiom, Zhur. ush., nos. i gorl. bolez., 1925, no. 9-10.
6. Collet, F. J., and Charachon: Angioma du larynx, Lyon méd. **155**:404 (March 31) 1935.
7. Wolf, G. D.: Angioma of the Larynx, Laryngoscope **33**:233, 1923.
8. Penna, O.: Hämangiom des Stimmbandes, Zentralbl. f. Hals-, Nasen- u. Ohrenh. **3**:324, 1923.
9. Quix, F. H., cited by Raaflaub.[11]
10. Jones, J. A.: A Case of Hemangioma of the Right Vocal Cord, J. Laryng. & Otol. **38**:528, 1923.
11. Raaflaub, H.: Haemangioma cavernosum eines Sängerkehlkopfes, Schweiz. med. Wchnschr. **56**:196 (March 6) 1926.
12. Bernhardt: Hämangiom des Larynx, Internat. Zentralbl. f. Ohrenh. **26**:202, 1926.
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16. Berendes, J.: Ueber ein infiltrierend wachsendes Hämangiom des Kehlkopfes, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **146**:479, 1939.
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18. Monteiro, A.: Hemangioma cavernoso do laringe, Acta med., Rio de Janeiro **6**:263 (Nov.) 1940.
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from the present review because of the location of the tumors.

ETIOLOGIC FACTORS

Hemangioma of the larynx occurs infrequently. Over 90 per cent of the patients have been adults, and two-thirds have been males. In some cases the condition has undoubtedly been congenital and was made manifest shortly after birth. Kramer and Yankauer [21] have suggested as probable etiologic factors severe cough traumatizing the vocal cords, faulty or excessive use of the voice and acute infections. These observers, with Howarth,[26] are the only ones who hold hemangioma to be at all common.

PATHOLOGIC TYPES

Two main types of hemangioma have been described—the cavernous and the simple. The tumor is designated as cavernous angioma when its vascular channels are widely dilated and the connective tissue septums thin; it is called simple angioma when composed of many small blood vessels. Sometimes an inflammatory tumor of the larynx rich in new-forming capillaries is mistaken for simple hemangioma, and varicosities may be difficult to differentiate from cavernous hemangioma. Ewing [27] stated that "the physiology of vessels necessitates special standards in the interpretation of tumor processes, and this peculiarity has led to much difference of opinion as to what constitutes an angioma." In addition, a rare metastasizing cavernous angioma has been described; this type exhibits certain peculiar features of cancer and is eventually fatal, chiefly through internal hemorrhage and anemia. The Jacksons [28] recorded a case in which a tumor of this type apparently took origin in the larynx.

DIAGNOSIS

Entirely different sets of symptoms characterize the infantile and the adult form of hemangioma.

Because of the subglottic position of the infantile form, a slight infection of the upper respiratory tract is often sufficient to cause symptoms of respiratory distress. Wheezing and labored respiration, quite similar to what is seen in streptococcic laryngitis, are present. However, the signs of acute infection are not so prominent; the fever is not so high, nor are the local signs of an infection of the throat so marked. Suehs and Herbut [17] have commented on the tendency toward periods of remission of symptoms in these cases. The presence of hemangiomatous involvement of other areas of the body (case 1, fig. 1 *A* and *B*) should excite suspicion; in 3 of the 8 reported cases there was such involvement. Dermal hemangioma is common in newborn infants and is therefore, even when coupled with respiratory distress, no sure sign of the presence of subglottic hemangioma.

Direct laryngoscopic examination of a young infant with severe dyspnea may be difficult, and a subglottic tumor lying diffusely under the mucous membrane may not be seen readily. Probably no attempt should be made to obtain a biopsy in such cases because of the danger of hemorrhage. The absence of inflammatory swelling and of a diphtheritic membrane is a valuable negative sign.

Lateral roentgenograms of the larynx may show a discrete tumor (case 1, fig. 2 *A*) in the subglottic larynx. In 3 of the 8 cases of infantile hemangioma the diagnosis was made only at autopsy, and in 2 additional instances autopsy confirmed the diagnosis.

In cases of the adult type of hemangioma the symptoms are often vague and of extremely long duration; years may elapse before the patient seeks medical aid. Hoarseness, followed by cough, dyspnea, hemoptysis and dysphagia, was the most common complaint in the series reported by Kramer and Yankauer.[21]

The tumor as seen through a laryngeal mirror may be small or may be extremely large. It is usually described as somewhat resembling a raspberry, irregular in surface and purplish in color, though it may be red, pink or occasionally white. Ulceration is rarely noted. The tumor is usually attached by a broad base to the underlying structures (case 2, fig. 3 *B*), although in certain cases it may arise from a delicate pedicle. It has been seen to spring from a vocal cord, a ventricular band, an arytenoepiglottic fold, an arytenoid and the epiglottis. Kramer and Yankauer [21] stressed the diagnostic importance of the "phonation sign of Menzel," which consists of increased firmness, erection, diminution in size and deepening of hue of the tumor during phonation.

TREATMENT

Relief of dyspnea often becomes an urgent necessity in cases of laryngeal hemangioma of the infantile type. Intubation of the larynx has been reported by Levbarg,[25] Sweetser [23] and Philips and Ruh [29]; hemorrhage into the tumor

26. Howarth, W.: A Note on Hemangioma of the Larynx, J. Laryng. & Otol. **45**:803 (Nov.) 1930.

27. Ewing, J.: Neoplastic Diseases, New York, Paul B. Hoeber, 1922, p. 224.

28. Jackson, C., and Jackson, C. L.: Cancer of the Larynx, Philadelphia, W. B. Saunders Company, 1939, p. 180, plate V.

29. Philips, J., and Ruh, H. O.: Angioma of the Larynx, Especially Its Relation to Chronic Laryngitis, Am. J. Dis. Child. **5**:123 (Feb.) 1913.

and death by suffocation occurred in Sweetser's case. Tracheotomy, performed as low as possible to avoid cutting the tumor, is the best procedure in the opinion of most observers. In Shurly's case, cited by Sweetser, the tumor was encountered in the tracheal incision, and fatal hemorrhage ensued. Lateral roentgenograms of the neck, taken for soft tissue detail, may give definite information concerning the size and the extent of the tumor prior to tracheotomy. Roentgen radiation or radium, cautiously used to avoid perichondritis, usually produces a rapid decrease in the size of the tumor. In the cases of New and Clark hemangioma responded well to radium therapy, and in Levbarg's case and our case 1 it responded well to roentgen therapy. If tracheotomy has not been done as a preliminary step, the patient should be closely watched for an increase of dyspnea during the period of irradiation. He should be kept in a hospital where facilities for emergency tracheotomy are instantly available. Failure to respond to irradiation may make thyrotomy necessary.

A small tumor of the adult type may be removed through the laryngoscope by means of seizing or cutting forceps. Profuse hemorrhage is unlikely, and recurrence is rare. Fatal hemorrhage has occurred and is especially to be feared when a larger tumor is dealt with, particularly one attached by a fairly broad base. Such a tumor is best treated by coagulation with surgical diathermy or by irradiation with radon implants, radium needles or roentgen rays. If the pedicle is easily reached through the laryngoscope, a suture may be passed through the base of the tumor, which may then be excised above this level. Thyrotomy offers a suitable approach to a tumor within the larynx, while lateral transthyroid pharyngotomy may be necessary in dealing with a large extralaryngeal one. Quix [9] reported a case of hemangioma of the piriform sinus with removal of the tumor through lateral pharyngotomy.

REPORT OF CASES

CASE 1.—M. S. D., a white girl aged 7 weeks, was admitted to McPherson Hospital at 1 a. m., Nov. 12, 1939, having been referred by Dr. A. H. London Jr. The infant had been perfectly well until, at the age of 3 weeks, she contracted an infection of the upper respiratory tract. There was no marked trouble, however, until she was 6 weeks old, at which time some wheezing was noted. Although she had no elevation of temperature at the time of her admission, the breath sounds were noisy and high pitched over the entire chest and there was marked inspiratory stridor. Cough was present and was "croupy." Cutaneous hemangioma was noted at numerous sites during the examination, the largest two lesions being located on the left upper eyelid and over the lower part of the back, respectively (fig. 1 *A* and *B*).

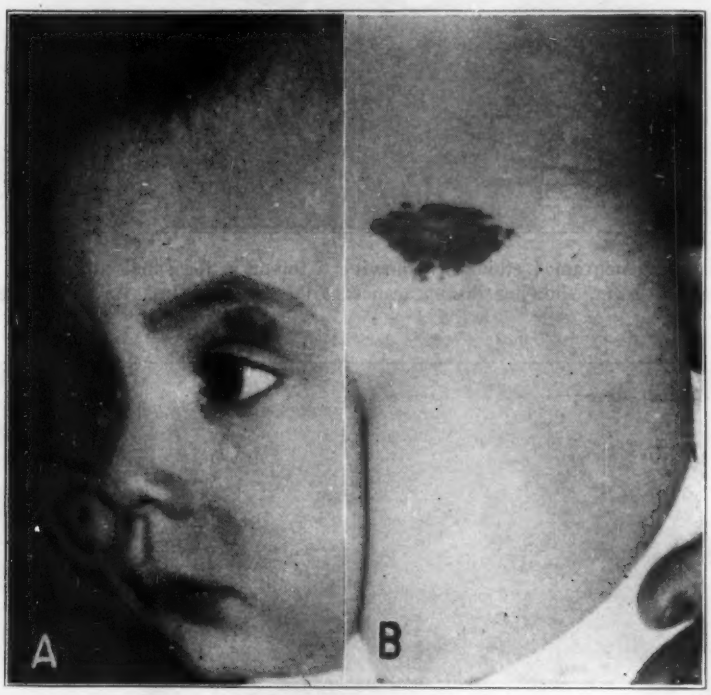

Fig. 1.—*A*, hemangioma of the left eyelid; *B*, hemangioma of the sacral area.

A roentgenogram (fig. 2 *A*) showed the epiglottis in a normal position and a moundlike mass in the subglottic part of the larynx, projecting from the posterior tracheal wall. The airway below the point of obstruction was of normal caliber but appeared to be reduced about 50 per cent at the site of the tumor.

At direct laryngoscopic examination, no abnormality of the hypopharynx or the epiglottis was noted. Both

arytenoids moved normally, and the glottic aperture appeared normal in caliber. The subglottic part of the larynx was not well visualized through the laryngoscope. A bronchoscope was not passed at this time because it was felt that such a procedure might necessitate tracheotomy, which could probably otherwise be avoided. By November 23 the symptoms had abated, and the child was dismissed from the hospital.

Three weeks later (December 13) the patient was seen again. Breathing had been difficult, food had been poorly taken and the child had lost weight. On Jan. 7, 1940, she was readmitted to the hospital with marked difficulty in breathing. There was indrawing of the soft tissues at the epigastrium, at the suprasternal notch and in the thoracic interspaces. Roentgenograms showed that the lungs were clear and that the same moundlike mass was still present. The next day (January 8) the child became decidedly worse and was taken to the operating room. A 3.5 mm. infantile bronchoscope was passed through the larynx into the trachea. A firm obstructing agent was encountered in the subglottic area, but no bleeding was induced in spite of the vigorous pressure required to pass the bronchoscope beyond the point of obstruction. Respiratory distress was immediately relieved by bronchoscopy, and tracheotomy was done with the bronchoscope in place. The bronchoscope again met resistance as it was withdrawn through the narrowed area. Following tracheotomy, the temperature rose as high as 104 F.; on the fourth postoperative day it had returned to normal.

On February 28 the size 1 tracheotomy tube was replaced by size 0. The mother reported that the child was sleeping well and had been gaining slowly in weight. A lateral roentgenogram of the neck taken on April 25 did not show much increase in size of the airway through the subglottic part of the larynx. By August 1 the child's weight had increased to 15 pounds 14 ounces (7,200 Gm.) or about 8 pounds (3,628 Gm.) more than at the time of tracheotomy. One year after tracheotomy (Jan. 4, 1941) the child's weight was 20 pounds (9,072 Gm.). At this time the larynx and the trachea were inspected directly by laryngoscopy and bronchoscopy with the purpose of determining whether the airway was ample and whether or not it would be possible to implant radon seeds directly into the subglottic tumor. The upper part of the larynx and the trachea again appeared normal. A 4 mm. bronchoscope met obstruction; a 3.5 mm.

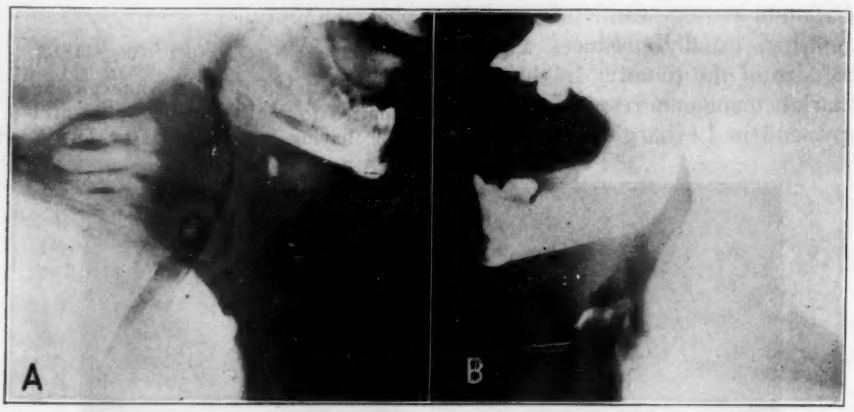

Fig. 2.—*A*, lateral roentgenogram (retouched) showing a tumor in the subglottic part of the larynx (Jan. 13, 1939); *B*, lateral roentgenogram, showing disappearance of the subglottic mass after roentgen therapy (Jan. 29, 1941).

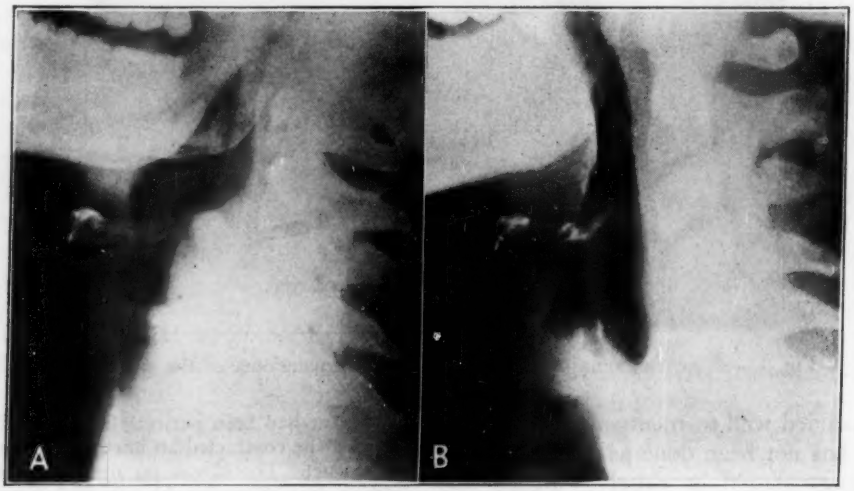

Fig. 3.—*A*, lateral roentgenogram showing hemangioma; *B*, tumor after it has fallen back into the upper part of the esophagus during swallowing.

bronchoscope, however, passed without difficulty. The tracheobronchial tree was explored and found to be normal below. During withdrawal of the bronchoscope, it was noted that the major encroachment on the tracheal lumen was in the posterior quadrant on the right side. The impression gained at that time was that the growth, if it was one, was submucous in location, nor was it thought that radon seeds could be implanted easily. The caliber of the airway through the subglottic portion of the larynx had increased considerably but was still inadequate.

Under the direction of Dr. W. W. Vaughan, six roentgen treatments were given to alternate sides of the neck, each treatment consisting of 100 roentgens filtered by 0.4 mm. of tin plus 1.0 mm. of copper. Further diminution of the mass was subsequently noted (fig. 2 *B*). One radium treatment was given over each

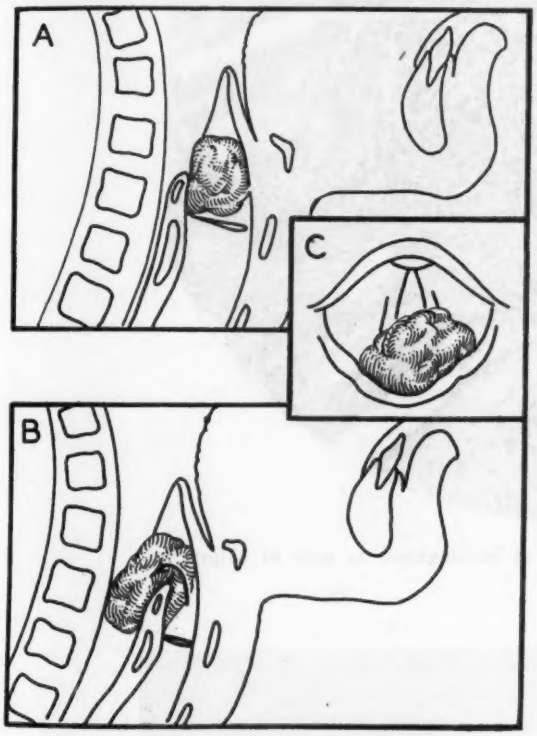

Fig. 4.—Schematic drawing to show the position and attachment of the tumor: *A*, sagittal view, tumor over the larynx; *B*, sagittal view, tumor in the esophagus; *C*, mirror view.

of the other tumors, 25 milligram hours on the back and 22 milligram hours on the left eyelid.

On Jan. 29, 1941, the tracheotomy tube was corked fully, and the child got along without difficulty. The tracheotomy tube was removed three days later. To date the child has had no sign of recurrence.

Case 2.—M. S., a white man aged 20 years, was first seen at McPherson Hospital Dec. 20, 1941, referred by Dr. M. B. Leath. Over a period of two years he had been complaining of a "lump" in his throat, difficulty in swallowing, occasional attacks of marked dyspnea and momentary inability to speak. At the time of his first visit he stated that all of these symptoms had been growing steadily worse.

The patient, a typical college football player, seemed a perfect physical specimen. Examination failed to reveal any abnormality except the lesion in the throat. Mirror inspection of the hypopharynx showed the epiglottis to be normal. When the patient phonated, the anterior one third of each vocal cord was also completely normal in appearance. A walnut-sized (2.5 cm.) mass obscured the view of the posterior two thirds of the true and the false cords, the arytenoids and the arytenoepiglottic folds. The mass, red to purple, had a somewhat irregular outline. Its richly vascular appearance immediately forbade any casual attempts to obtain tissue for microscopic study. As seen by mirror, the mass seemed to take origin above the level of the true cords and to extend upward to a point level with the tip of the epiglottis.

A lateral roentgenogram of the neck (fig. 3 *A*) showed a walnut-sized (2.5 cm.) soft tissue mass which obscured the posterior one third of the laryngeal ventricle. During fluoroscopic examination it was noted that when the patient swallowed the tumor fell backward into the esophagus, causing partial obstruction (figs. 3 *B* and 4).

At direct laryngoscopic examination, Jan. 16, 1942, the tumor was found to be attached to the laryngeal surface of the arytenoids by a broad pedicle. It could be pushed backward into the esophagus, leaving the larynx practically normal in appearance. A large caliber (17 gage) needle was inserted into the tumor. Strong suction was applied through the needle by means of a syringe, and a small quantity of clear colorless fluid was obtained. A minute fragment of tissue was also removed but proved inadequate for microscopic diagnosis. On January 23, inasmuch as colorless fluid had been obtained from the tumor, a generous biopsy specimen was taken. Profuse hemorrhage immediately ensued and was stopped with some difficulty by diathermic coagulation. The biopsy specimen was examined microscopically by Dr. Clark E. Brown, who reported it to be cavernous hemangioma (fig. 5).

Six 1 millicurie gold radon implants were inserted into the growth on January 26 (fig. 6 *A*). This procedure was attended by little bleeding. There was a noticeable decrease in size of the tumor within five days. On February 7 the patient complained of considerable pain in the throat, and mirror examination of the larynx showed moderate irradiation mucositis. On March 18 the tumor appeared to be about one half of its original size (fig. 6 *B*), and two of the implants had been extruded. On May 1 the patient stated he was no longer troubled by any of the symptoms previously related to his throat. Mirror inspection on that date, however, showed that some tumor persisted. Since that time the patient has joined the Armed Forces of this country, and further observation has not been possible.

SUMMARY

To date, 123 instances of hemangioma of the larynx have been recorded in the available literature. Two distinct classes have been described: the adult—cases numbering 116—and the infantile—cases numbering 7. One additional case in each class reported herein makes the total 125 cases.

In several instances the diagnosis of hemangioma of the infantile larynx was not made until postmortem examination. However, dermal hemangiomatosis associated with recurring afebrile laryngeal obstruction may suggest the

Fig. 5.—High power photomicrograph of hemangioma as seen at biopsy.

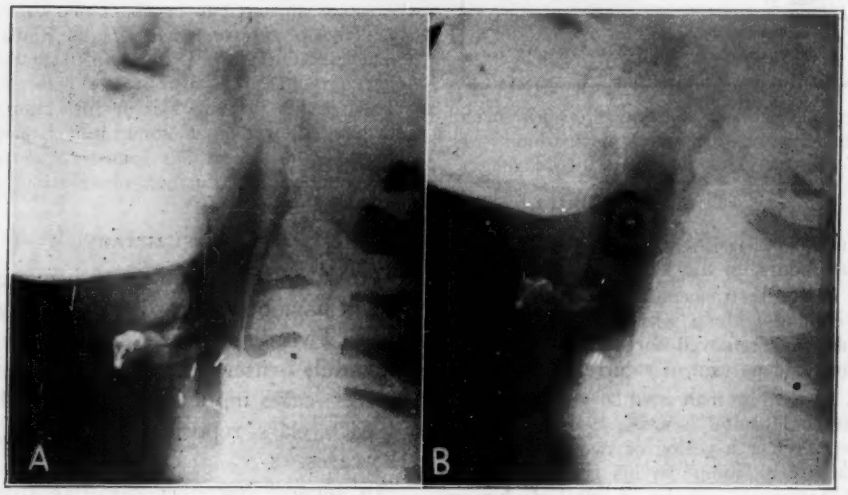

Fig. 6.—*A*, lateral roentgenogram showing distribution of gold radon implants (Jan. 26, 1942); *B*, lateral roentgenogram showing decrease in the size of the tumor (March 18, 1942).

proper diagnosis of this form of laryngeal hemangioma.

Majority opinion holds tracheotomy to be the most suitable method of relieving dyspnea caused by hemangioma of the infantile larynx. Small tumors of the adult type of hemangioma may be removed by forceps. Larger tumors demand careful selection of approach, which may be made through the mouth, by laryngofissure or by lateral pharyngotomy. Electrodesiccation, surgical excision or irradiation may prove successful.

CONCLUSIONS

1. Roentgen therapy proved entirely satisfactory in reducing the tumor in case 1. It should be noted, however, that one year had elapsed between tracheotomy and roentgen therapy.

2. Irradiation by radon implants reduced the size and eliminated the symptoms in case 2, although some tumor persisted. Ligation and excision were contemplated.

3. Lateral roentgenograms of the neck taken for soft tissue detail gave valuable information prior to tracheotomy by revealing the location and the extent of the growth in case 1.

4. Hemorrhage is to be feared in removing a large tumor. In spite of reasonable precautions, alarming hemorrhage occurred during biopsy in case 2.

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PREVENTION OF SECONDARY POST-TONSILLECTOMY HEMORRHAGE WITH SULFATHIAZOLE GUM

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DANVILLE, VA.

The incidence of delayed, or secondary, hemorrhage following tonsillectomy is not great, but the complication occurs with sufficient frequency to warrant attention. This postoperative event, while alarming to the patient, is regarded as more annoying than serious by the surgeon. Occasionally the bleeding is of a severity necessitating a transfusion. Indeed, because of the rapid replacement of the blood lost and the apparent prompt cessation of tonsillar bleeding in the patient treated by transfusion, this procedure has been advised in all cases other than that of transient hemorrhage.

Primary hemorrhage occurs within twenty-four hours after tonsillectomy and is due to incomplete hemostasis during operation, incomplete operation, relaxation of the walls of blood vessels or unavoidable slipping of a ligature during violent coughing or vomiting. Postoperative bleeding secondary to blood dyscrasias, acute inflammation at the time of operation, hypertension, arteriosclerosis or other causes brought out by the preoperative history and examination, known as predisposing causes of bleeding, are not considered.

Secondary hemorrhage takes place usually from three to fourteen days after operation, often at the time the slough is separating from the tonsillar fossa. The hemorrhage is said to be a result of necrosis with erosion of the vessel wall, vitamin C deficiency, sexual excitation, emotional strain, physical exertion or eating rough foods.

It is a matter of wonder that the large pharyngeal wounds so exposed to bacteria heal as well and as rapidly as they do. The role of infection in the causation of bleeding in the tonsillar fossa seems to be paramount. Whether a thrombus in one of the many severed blood vessels is softened and liquefied by infection, or whether some specific necrotizing or hemolytic toxin is present which erodes into either the newly formed capillaries in the granulating surface or the recently traumatized pharyngeal vessels, is not clearly understood. However, a reduction of the bacterial inflammation by the local use of sulfonamide compounds has yielded encouraging results.

Observations have shown that it is impossible to predict before or during the operation which patients are likely to bleed after the operation. Secondary hemorrhage occurs in no greater frequency with a blood coagulation time of eight minutes than with one of four minutes or with a prothrombin time of twenty-five seconds than with one of fifteen seconds. Haffly [1] emphasized the fact that routine determination of blood clotting time is of little value in the avoidance of postoperative hemorrhage. If the history suggests a hemorrhagic tendency, a complete study of the blood should be made.

The amount of blood lost during the operation does not indicate the patient who will bleed during the postoperative period. The average of the recorded amounts of blood lost in a group of 100 patients with uneventful convalescence was 56 cc.; in a second group of patients who had postoperative bleeding severe enough to cause them to notify the surgeon the average was 41 cc.

In my experience the preoperative and postoperative use of coagulants, such as oxalic acid, or ascorbic acid had no apparent effect in the prevention of operative or postoperative bleeding. Advice, however, is usually given to force the intake of citrus fruit juices before and after operation.

The methods of controlling secondary hemorrhage are many and varied; they include blood transfusion, injection of the fossa with a solution of procaine hydrochloride and epinephrine hydrochloride and local application of astringents and coagulants. Since the tissue is friable and necrotic, it is difficult to grasp the bleeding point with a hemostat, and sutures tend to cut through. Most often the gentle removal of the clot, sedation with a morphine salt and pressure applied to the fossa with cotton sponges are sufficient to control the bleeding. Cauterizing the bleeding point with a saturated solution of silver nitrate is often successful in stopping persistent bleeding, provided the silver nitrate can be accurately applied to the dried area. Cunningham [2] found

1. Haffly, G. N.: Preoperative Detection of Bleeding Tendency in Patients with Otolaryngologic Disorders, Arch. Otolaryng. **37**:622-627 (May) 1943.

2. Cunningham, B. P.: Clinical and Experimental Studies with Sulfapyridine as Hemostatic Agent, Ann. Otol., Rhin. & Laryng. **51**:301-316 (June) 1942.

the local application of powdered sulfapyridine to be effective in the control of vascular oozing in delayed tonsillar hemorrhage.

Preliminary study of the effects of routine postoperative use of sulfathiazole gum indicated a reduction in the incidence of secondary hemorrhage. The gum used contained 3¾ grains (25 mg.) of sulfathiazole; when the gum was chewed for one-half to one hour, the average salivary concentration of sulfathiazole was 70 mg. per hundred cubic centimeters. The blood sulfathiazole [3] of children chewing 1 tablet for one-half hour for twelve daily doses showed a maximal concentration of 0.5 mg. per hundred cubic centimeters. Adults chewing 2 tablets for the same period showed a peak concentration of 0.8 mg. per hundred cubic centimeters. In a small number of cases no evidence was found to indicate an increased absorption of the sulfonamide compound from the area of operation over the intact pharyngeal mucous membrane.

The gum is pleasant, practical, simple to administer and well tolerated by the patient; no untoward effects have been noted. The dosage is 1 to 2 tablets chewed for one-half to one hour four to six times a day, depending on the age and the weight of the patient.

The chewing mechanically keeps the pharyngeal muscles supple, lessening the difficulty in swallowing, and appears to shorten convalescence and hasten healing. The most notable objective finding has been the clean smooth appearance of the granulating tonsillar fossa and the absence of inflammatory reaction of the pharynx throughout the postoperative period. In view of the low concentration of sulfathiazole in the blood, routine urinanalysis and examinations of the blood were not done.

Arnett [4] showed experimentally that when gum is chewed the medication does not reach the tonsils and the posterior portion of the pharynx unless the patient is in the recumbent posture with the head lower than the shoulders. For this reason the patient is advised to assume this position for chewing the gum.

Victor [5] reported on the local use of sulfanilamide in tonsillectomies. Although locally sulfanilamide powder was administered only three times in the first twenty-four hour period after operation he noted a favorable effect on postoperative oozing and on temperature, leukocytosis, inflammatory reaction, healing and convalescence.

It is difficult to evaluate the effect of any drug or method on the prevention of postoperative hemorrhage because of the many variable factors. This bleeding often occurs in cycles; all surgeons have been faced with it half a dozen times in one week and not another time for several months. In my small series of 150 patients who used the gum 2 had mild hemorrhages; both of these patients had bled freely at operation and chewed the gum sparingly during convalescence.

The salivary concentration of sulfathiazole over a prolonged period seems to produce a locally effective therapeutic dosage. Sulfathiazole tablets used internally or dissolved on the tongue were not found to be of value.

One objection to the local use of the sulfonamide compounds is that the patient may become seensitized and that then the use of the drug in a more serious disease at a later time may be impossible. Some authorities are not impressed by the theoretic view of acquired sensitivity to a sulfonamide compound or of the development of resistance to a sulfonamide compound after local application of the drug. It seems unlikely that the local use of a sulfonamide compound in minor infections for short periods results in sensitivity or acquired resistance to the drug.

Recently attention has been called to the relationship of salicylates to hemorrhage, a relationship which is applicable to this problem in that acetylsalicylic acid in various forms has been used freely to relieve the post-tonsillectomy pharyngodynia. The salicylates are related chemically to dicoumarin (3,3′-methylenebis [4-hydroxycoumarin]) and other hemorrhage-provoking agents. The hypoprothrombinemia caused by salicylates can be prevented by the administration of vitamin K, and this substance has been used successfully by some surgeons in the prevention of post-tonsillectomy hemorrhage. The salicylates also cause increased excretion of vitamin C and tissue depletion of ascorbic acid in animals, and their use may lead to a scorbutic state. Further investigation of this problem is necessary to clarify the picture as far as post-tonsillectomy hemorrhage is concerned.

CONCLUSION

A preliminary study of the routine use of sulfathiazole gum after tonsillectomy indicated a reduction in the incidence of secondary hemorrhage. In addition, the gum appeared to exert a favorable effect on the healing of the pharyngeal wound.

Masonic Temple Building.

3. This datum was furnished by Dr. E. R. Neary of the White Laboratories.

4. Arnett, J. H.: Medication by Chewing Sulfadiazine and Other Drugs Incorporated in Paraffin Base: Preliminary Report, Am. J. M. Sc. **205**:6-8 (Jan.) 1943.

5. Victor, K. N.: Local Use of Sulfanilamide in Tonsillectomies, Arch. Otolaryng. **37**:438-439 (March) 1943.

SURGICAL TREATMENT OF NASAL OBSTRUCTION

INDICATIONS FOR A PLASTIC APPROACH TO SEPTAL DEFORMITY; DETAILS OF PLASTIC PROCEDURES

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PROVIDENCE, R. I.

The benefits to be derived from a well executed submucous resection for the relief of nasal obstruction when this type of treatment has been indicated cannot be denied. Unfortunately, owing to the lack of any well established indication, the operation has been used to relieve every type of nasal obstruction and has so frequently failed to benefit the patient that many otolaryngologists now deprecate its value.

With the impetus given to the study of nasal physiology in the past two decades, physicians have come to believe that the distribution of air in the nasal passages is as important as the quantity. Thus, in cases in which the obstruction is due solely to a septal abnormality a submucous resection can ordinarily be expected to assure an adequate airway. But when other factors concerned in the distribution of air, such as a faulty conformation of the vestibule, the olfactory sulcus or the choanae, are involved, even a technically perfect submucous resection may fail to afford relief. Indeed, it may serve only to aggravate the complaint.

Physiologists concede that if the current of air which traverses the nasal fossae is to be conditioned properly it must pass through at a given velocity and under a given pressure. These factors are influenced by the size, the shape and the inclination of the nares, the conformation of the olfactory sulcus and the shape and the size of the choanae. According to Proetz,[1] it is essential that the nares be somewhat smaller than the choanae in order to maintain proper peaks of positive and negative pressures. Suppose that the nares were diminished in size as the result, say, of an unduly thick columella or thick alae or by a caudal deflection of the septum. On inspiration there would be an increase of negative pressure and on expiration an increase of positive pressure; obviously, the ventilation of the sinuses, in which air exchange is dependent entirely on intranasal pressure, would be impaired. Under such circumstances a submucous resection could not be expected to diminish the disturbance of function. The procedure indicated here would be that of narrowing the columella and the alae and reducing the dislocation of the caudal end of the septum.

A dependent tip of the nose may misdirect the air current. Such a faultily directed current playing on a localized area of mucous membrane has a tendency to dry up the secretions, interfere with ciliary activity and otherwise destroy functional usefulness. In addition, such a current of air concentrated on a delicate membrane is likely to irritate the sensory nerves and give rise to headache, neuralgia and reflex disturbances. Frequently, elevating the tip of the nose by attaching the columella to the septum at a higher level will relieve these symptoms. A case in mind may be reviewed briefly. Mr. X., complaining of impaired breathing, five years earlier had had a technically perfect submucous resection which afforded no relief. His turbinates were later cauterized, and this likewise failed to effect any improvement. When he came to see me I elevated the tip of the nose with the finger to inspect the vestibule. The patient immediately informed me that he could breathe perfectly. The lobule was elevated surgically, and since then he has had no nasal discomfort.

In the past few years I have adopted the following routine practice, which in my hands has proved satisfactory:

I. I perform submucous resection in the usual manner in cases in which the obstructing factor lies posterior to an imaginary line drawn from the nasal spine of the frontal bone to the nasal spine of the maxilla. For convenience, I call this the posterior compartment (fig. 1).[2]

Presented as a candidate's thesis to the American Laryngological, Rhinological and Otological Society in June 1943.

1. Proetz, A. W.: Essays on the Applied Physiology of the Nose, St. Louis, Annals Publishing Company, 1941, chap. 7.

2. Fomon, S.: Personal communication to the author, 1942.

II. In all cases in which the obstruction lies anterior to this imaginary line I employ an approach with which the plastic surgeon is familiar but with which the otolaryngologist is not so familiar. I believe that better results can be assured by using the plastic approach in conjunction with the otolaryngologic concept of what should be accomplished.

anterior palatine nerves with three applicators wrung dry of a mixture of equal parts of a 10 per cent solution of cocaine hydrochloride and a 1:1,000 solution of epinephrine hydrochloride.

The external nasal pyramid is anesthetized by blocking (1) the infratrochlear nerve, (2) the external nasal nerve and (3) the infraorbital nerve with a 2 per cent solution of procaine hydrochloride containing 5 to 10 drops of a 1:1,000 solution of epinephrine hydro-

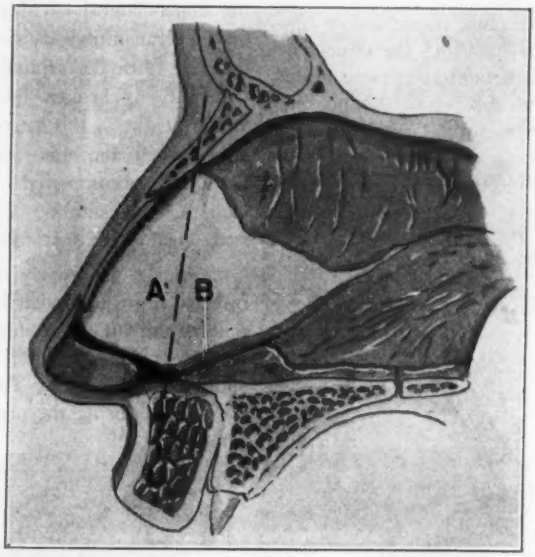

Fig. 1.—Arbitrary line dividing the nose into an anterior and a posterior compartment (*A* and *B*).

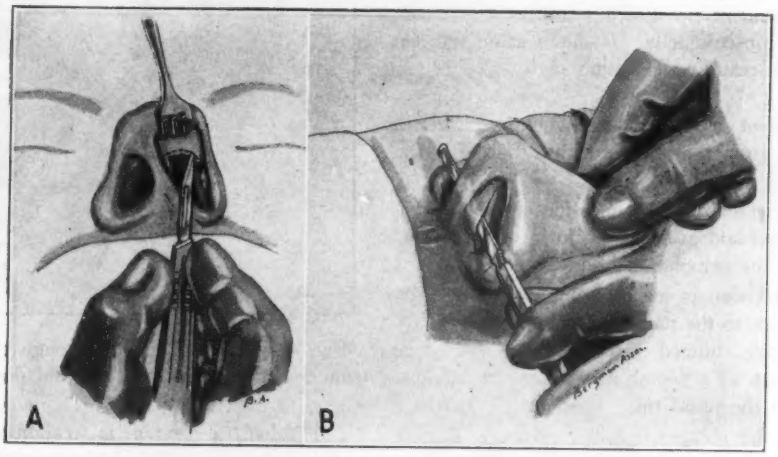

Fig. 2.—*A*, initial incision along the caudal edge of the upper lateral cartilage. *B*, transfixion of the septum with a button end knife.

PLASTIC PROCEDURES

Cleansing.—1. The vibrissae in the vestibules are clipped. 2. The face and the vestibules are thoroughly cleansed with soap and water, then swabbed with alcohol and ether.

Anesthetization.—The nasal fossae are anesthetized by blocking (1) the anterior ethmoidal nerve, (2) the sphenopalatine ganglion and (3) the nasopalatine and chloride to the ounce. The injections are made intranasally.

Exposure of the Septum.—1. An incision is made along the ledge formed by the caudal end of the left upper lateral cartilage.

A similar incision is made on the opposite side (fig. 2 *A*).[3]

(Footnote on next page)

2. A button end knife is passed from one incision to the other and the membranous septum is divided, the knife hugging the cartilage (fig. 2 *B*).[3] At the completion of this incision, the caudal margins of the septum and the upper lateral cartilages are exposed to direct vision.

Management of the Septal Cartilage.—(*a*) When the only deformity is a dependent nasal tip: If all that is required is an elevation of the tip of the nose, the columella is merely reattached to the caudal edge of the septum at a higher level (fig. 3).

(*b*) When lower portion of septum is buckled or dislocated: 1. Through the original incisions the structures overlying the upper lateral cartilages are separated in the plane just above the perichondrium. Into the pockets thus created an angulated retractor is inserted, and

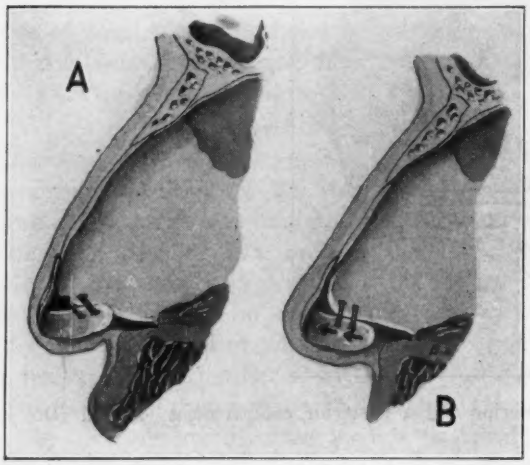

Fig. 3.—*A*, dependent tip showing sutures higher on septum and lower on columella. *B* shows same sutures tied in place, with resulting elevation of tip.

with the instrument as a guard, the upper lateral cartilages are cut from the septum with a Bard-Parker knife.

2. The mucoperichondrium on one side of the septum is then elevated and laid aside in the form of a curtain, to be replaced at the completion of the operation.

3. An oblique incision is made through the cartilage from the nasal spine to the nasal dorsum (fig. 4). This section of cartilage, hinged on the nasal spine, is reserved to function as a septal strut to insure against loss of support to the nasal tip.

4. Cephalad to the oblique incision, variously shaped cartilaginous strips are then removed to break the spring of the cartilage and make it possible to untangle and reposition the septum without total loss of its structure. (I have seen patients in whom the entire supporting septal cartilage has been sacrificed, leaving a flapping membrane, which on inspiration was drawn to one or the other lateral wall, interfering with the passage of the inspiratory current.)

3. Joseph, J.: Nasenplastik und sonstige Gesichtsplastik, Leipzig, Curt Kabitzsch, 1931. Fomon, S.: The Surgery of Injury and Plastic Repairing, Baltimore, Williams & Wilkins Company, 1939.

5. The mucoperichondrial flaps are approximated, and with one or two through and through sutures of heavy silk the columella is reattached to the septum.

(*c*) When septum lies at right angles to its sagittal plane: 1. The septum is freed from its attachment to the vomer by carrying a chisel through its full thickness along its attachment to the bone (fig. 5). The lower end of the septum is thus converted into a trap door flap hinged cephalad on a mucoperichondrial pedicle, having been freed ventrally by separation of the upper lateral cartilages from the septum, caudally by the transfixion incision and dorsally by the chisel cut. 2. With the septum thus freed, the spring of the deformity is broken by removing strips of cartilage at the height of the convexity. 3. The septum is then adjusted in the midline. 4. The mucoperichondrial flaps are approximated. 5. With one or two through and through sutures of heavy silk the columella is reattached to the septum at the desired level of elevation.

6. A pair of properly sized Ash nasal splints are then inserted into the nostrils to hold the septum in the midline until it has firmly reattached itself. At the end of five or six days the splints are withdrawn and all sutures are removed. The patient is instructed to wear the splints during the night for two weeks thereafter.

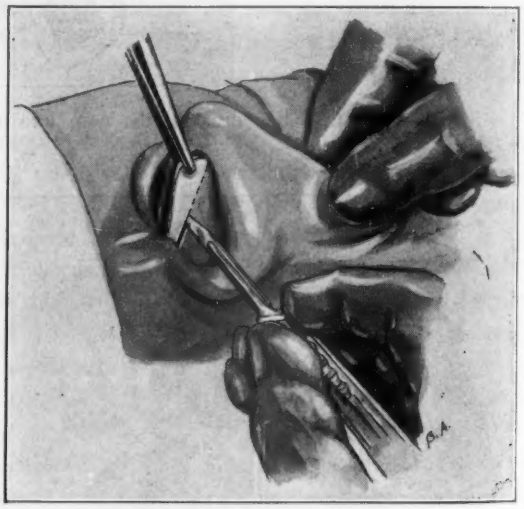

Fig. 4.—Oblique incision through the septal cartilage from the nasal spine to the nasal dorsum.

(*d*) When the septum is straight with the exception of the caudal end, which deviates or projects into one or the other nostril, causing obstruction and distortion of the nasal tip and the nasolabial angle: One of two procedures is employed, depending on the length of the nose.

In a long nose the projecting septal cartilage is excised after transfixation. This may leave the septum in the midline and remove both the obstruction and the lobular deformity.

In a nose of normal length the septum does not permit such a sacrifice of tissue. Here the caudal end of the septum is hinged (1) by breaking the spring of

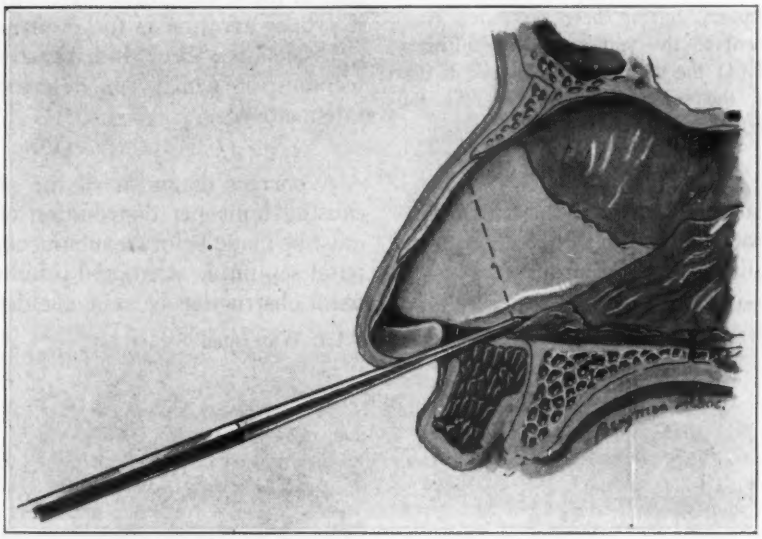

Fig. 5.—Chisel cut through the full thickness of the septum, separating the septum from its attachment to the vomer. The dotted line indicates the direction of an incision to break the spring of the cartilage.

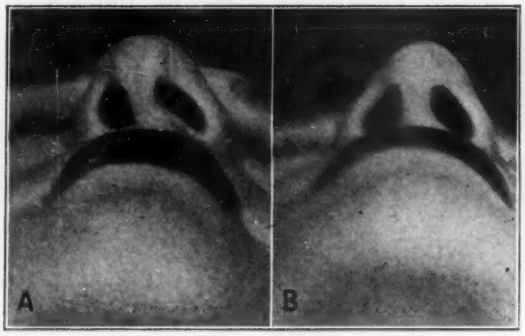

Fig. 6.—*A*, preoperative photograph showing the nasal deformity caused by a septum deflected at an angle to its sagittal plane. *B*, postoperative result of correction of the deformity shown in *A*.

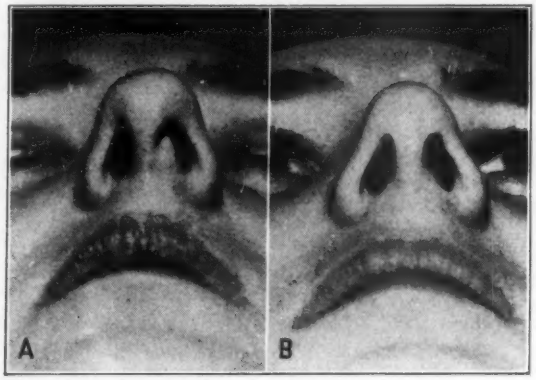

Fig. 7.—*A*, preoperative photograph showing the caudal end of the septum projecting into the left nostril and distorting the nasolabial angle. *B*, postoperative result of correction of the deformity shown in *A*.

the cartilage cephalad, at a higher level, and (2) by cutting through the full thickness of the septum with a chisel; (3) the septum, having been separated from its ventral attachment to the vomer, is then adjusted in the midline, and (4) the columella is sutured to the septum. Routinely, the septum is maintained in the midline by the insertion of Ash splints.

SUMMARY

Submucous resection is done in the usual manner when the nasal obstruction is caused entirely by bony abnormality of the septum.

When the obstruction is caused by faulty conformation of other structures, such as those entering into the formation of the vestibule, correction of these structural defects must also be made if proper aeration is to be effected.

Procedures through a transfixion incision, the technics of which are described, have proved satisfactory.

CONCLUSION

A correct diagnosis of the pathologic factors causing improper distribution of air in the nose must be made before a submucous resection of the nasal septum is attempted if failure to correct the nasal obstruction is to be avoided.

126 Waterman Street.

Case Reports

RHINOSPORIDIOSIS

MAJOR WILLIAM H. SEALE
CAPTAIN CLIFTON B. FLINN
AND
CAPTAIN EDWARD C. BRITT
MEDICAL CORPS, ARMY OF THE UNITED STATES

A Negro soldier presented himself for examination at the eye, ear, nose and throat section of the station hospital at Camp Wallace, Texas, on Jan. 4, 1943. His chief complaint was left-sided nasal obstruction of ten years' duration.

None of the patient's relatives had complained of a condition similar to his. The patient himself had always been well and had never consulted a physician except for the illness in question. He was born in Texas, in 1921, and resided in one town or in an adjoining county all his life. From the age of 9 he did farm work until his induction into the Army, Dec. 1, 1942. His farm work included growing and handling corn, cotton, potatoes, peas and peanuts. He handled farm animals, including horses, mules, cows, hogs and chickens.

Since the age of 12, the left side of his nose had been "stuffed up," and he recalled that his mother had advised him to stop picking it. When he first sought medical attention, he was advised that he had a growth in his nose, of an unknown nature. Five years later, at the age of 17, he consulted a physician in Dallas, Texas, who "rubbed it with something" and advised him to return; however, he did not. Several other physicians were consulted without relief over a period of years. He gave no history of trauma or hemorrhage. The obstruction had become worse slowly. According to the patient, the tumor protruded from his nose several years prior to his examination by us. Since that time it had receded into his nostril.

The patient was a young, well developed adult male Negro aged 22 years. Physical examination gave negative results except for his left nostril. The laboratory findings were normal. Inspection of the left nostril revealed a cauliflower-like tumor causing complete obstruction. It was attached by a pedicle to the mucous membrane of the nasal septum, opposite the midportion of the left middle turbinate. The growth was removed by means of a snare. Profuse bleeding from the site of attachment of the pedicle followed. After this was controlled, the area of attachment was cauterized.

The specimen was sent to the Brooke General Hospital for study, and the following report was returned by Major W. D. Tigertt: "The gross specimen consists of a firm, nodular, irregular piece of tissue having the appearance of cauliflower, measuring 1.5 by 1.5 by 0.7 cm. On section there are noted white finger-like projections. Two sections of tissue submitted were examined microscopically and both show essentially the same picture: that of polypoid masses covered by a mixture of stratified and respiratory epithelium, which shows numerous enfoldings and pseudo gland formations. Sections are literally packed with round encapsulated organisms measuring from 40 to 400 microns in diameter. These organisms have a capsule staining intensity with eosin and a center of much lighter granular material; in some a small eosin-staining nucleus can be noted. Scattered large organisms contain hundreds of tiny round blue-staining masses with a central nucleus. This process of sporulation is most prominent directly beneath the covering epithelium, and in a few areas the spores are broken, discharging their contents to the surface. A few ruptured spores are noted deep in the tissue, and here there is a giant cell reaction. All of the tissue is infiltrated with lymphocytes and is relatively vascular. The diagnosis is rhinosporidiosis."

Healing was prompt and uneventful. The mucous membrane was smooth. The patient was observed during a period of three months, during which time there was no indication of recurrence.

Rhinosporidiosis was first described by Seeber, of Argentina, in 1895. The first case reported in the United States was that reported by Ellet in 1907. In both of these cases the lesion was of the nasal type. Similar lesions have since been found in the conjunctiva,[1] the lacrimal sac, the ear, the pharynx, the uvula, the larynx, the penis and the skin. It has been reported from a number of countries—India, Ceylon, the Philippine Islands, Europe and South America. Of the 12 patients with rhinosporidiosis whose cases were previously reported in the United States, 4 were seen in Texas.[2] Of these, 2 had nasal and 2 ocular lesions. Of the 2 patients in Texas with ocular lesions, one had bulbar and the other conjunctival involvement.[3] All were males. Only 1 of the total 12 patients was a female, and in this patient the lesion was of the nasal type.[4] In all there have been 9

1. Anderson, W. B., and Byrnes, T. H.: Rhinosporidium of the Conjunctiva, Am. J. Ophth. **22**:1383-1388 (Dec.) 1939. Barnshaw, H. D., and Read, W. T.: Rhinosporidiosis of the Conjunctiva, Arch. Ophth. **24**: 357-361 (Aug.) 1940.

2. Caldwell, G. T., and Roberts, J. D.: Rhinosporidiosis in the United States, J. A. M. A. **110**:1641-1644 (May 14) 1938.

3. Elles, H B.: Rhinosporidium Seeberi Infection in the Eye, Arch. Ophth. **25**:969-991 (June) 1941. Griffey, E. W.: Rhinosporidiosis, Am. J. Ophth. **22**: 1389-1390 (Dec.) 1939.

4. Pasternack, J. G., and Alexander, C. S.: Rhinosporidium Seeberi, Arch. Otolaryng. **27**:746-765 (June) 1938. Pasternack, J. G., and Alexander, C. S.: Rhinosporidiosis in Texas, Texas State J. Med. **38**:285-288 (Aug.) 1942. Ruchman, J.: Rhinosporidiosis (Seeber), Arch. Otolaryng. **30**:239-246 (Aug.) 1939.

Fig. 1.—Section of tissue under low power magnification showing many sporangia (*1*) of Rhinosporidium seeberi.

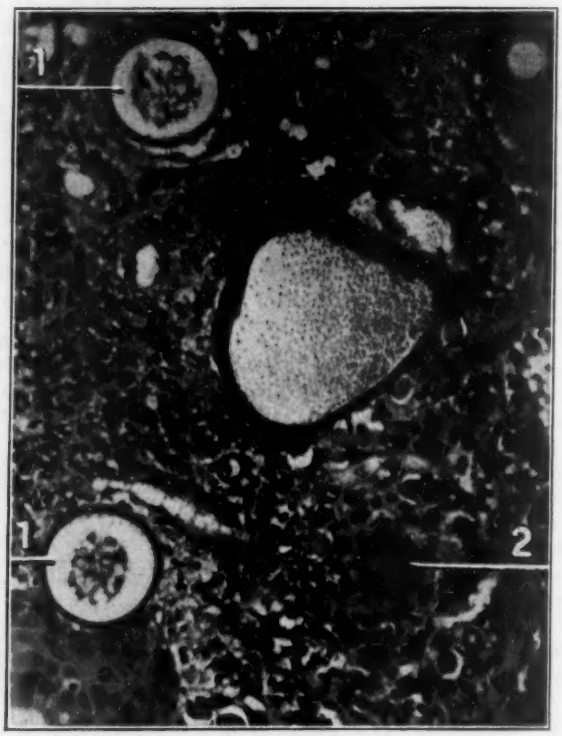

Fig. 2.—Section of tissue under high power magnification showing (*1*) sporangia of Rhinosporidium seeberi and (*2*) a giant cell.

patients with nasal and 3 with ocular involvement.

Rhinosporidiosis [5] is a polypoid tumor, and the causative organism was first considered a coccidial parasite, but the work of Ashworth in 1922 proved it to be a fungus, not a protozoan. The mode of transmission is unknown. The course of the disease is long, and there is a marked tendency to recur. Cultivation of the parasite has not resulted successfully, nor has animal inoculation. It usually affects males, both animals and human beings, especially children and young adults. Rhinosporidiosis affecting domestic animals has not been reported in the United States, but it has been observed in horses and cattle in other countries. The nasal variety is characterized by obstruction and epistaxis, although no history of the latter symptom was given by our patient. When it recurs it usually recurs at the original site. Regional lymph nodes are not enlarged. Spontaneous regression of the growth has been reported, and our patient gave a history of the tumor having been larger five years ago.

Treatment consists of removal of the tumor with destruction of the contiguous tissues by excision or electrocoagulation.

5. Strong, R. P.: Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases, ed. 6, Philadelphia, The Blakiston Company, 1942, pp. 1154-1155.

MENINGITIS DUE TO POST-TRAUMATIC CEREBROSPINAL RHINORRHEA

MILO C. SCHROEDER, M.D., LOMA LINDA, CALIF.

The escape of large amounts of fluid from the nose following an injury of the head was first described by Bidloo in 1700. Eight months after the injury meningitis developed, and the patient died.

The first description of this condition in the English language was published by Miller in 1826, but the term "cerebrospinal rhinorrhea" was first used by St. Clair Thompson in 1899. He described a case of cerebrospinal rhinorrhea of unknown cause. Of the 21 cases which he reported, 1 was traumatic. Johnson, in 1926, reported 21 cases, in 6 of which the condition was due to trauma.

The causes of a fistula leading into the nasal cavity through which cerebrospinal fluid escapes are (*a*) a bony defect in the posterior wall of the frontal sinus with defect in the dura, (*b*) a defect in the cribriform plate of the ethmoid bone and (*c*) defects in the walls of the sphenoid sinus. These may be due to trauma with fracture, damage at operative procedure; necrosis caused by pressure of a tumor or by pressure of a hydrocephalus, or congenital defect.

Despite the literature, probably the most common cause of cerebrospinal rhinorrhea is trauma resulting in comminuted fracture, such as might occur on violent contact with the instrument panel in the course of an automobile or an airplane crash. Julian Taylor has said, "It is one of the most serious complications of cranial injury." Several cases of operative repair of a fistula in the frontal sinus have been reported.[1]

The prognosis of cerebrospinal rhinorrhea is that sooner or later fatal meningitis will develop. Recently several cases have been reported in which the condition was cured by means of sulfanilamide, and I also wish to report 2 cases of cerebrospinal rhinorrhea complicated with meningitis in which there was full recovery under this form of therapy.

REPORT OF CASES

CASE 1.—Mr. U. O., aged 61, a Japanese barber, came for treatment on Jan. 2, 1942, complaining of pain in the right side of his face and in the right ear. There was also deafness of the right ear, which had developed slowly during the past two years. The patient heard noises of considerable intensity in the right side of his head and was aware of a peculiar numbness over the right side of his face and neck and the right shoulder. All these symptoms developed gradually over a period of two years and were of sufficient intensity to induce him to have numerous small areas of his neck and face burned with a hot iron several times. This was done by an irregular practitioner.

Examination showed no abnormality of the optic fundi and no drainage of nasal sinuses; the ears appeared normal. It seemed that there was a slight tendency to fall to the left. Tests showed both visual fields contracted and the physiologic blindspot doubled in size. Audiometric and vestibular tests showed a nonacting or "dead" labyrinth on the right side. A diagnosis of tumor of the cerebellopontile angle was made, and the patient was referred to Dr. Cyril Courville, who concurred and advised that the patient be sent to Dr. W. T. Grant for surgical intervention.

He was operated on by Dr. Grant on February 5, at the White Memorial Hospital. A cystlike tumor was found stretching the seventh and eighth cranial nerves and displacing the fifth nerve on the right side. It was removed through an opening made in the skull behind the right ear. The patient seemed to do well after the surgical treatment. Subsequently he complained of a salty clear fluid dripping from his nose when he leaned forward and running into his pharynx otherwise.

Several spinal taps were done to try to prevent leakage of the cerebrospinal fluid until healing could take place. After a few days the patient declared the drainage had ceased. This was obviously a ruse to gain permission to leave the hospital, for as soon as he arrived home I was called to attend him and he showed me how the clear fluid ran from his nose. He did not seem well but was not exhibiting any rise of temperature.

About one month after the operation he became violently ill, vomiting all his food and complaining of stiffness of the neck and headache. He had a temperature of 102 F. On March 3 he was admitted to the Loma Linda Sanitarium and Hospital, and a spinal tap was done to confirm the diagnosis of meningitis. This showed a pressure of 230 mm. of water increased by the Queckenstedt test to 250 mm.; it then fell to 200 mm. There was equal pressure on the two sides. The fluid was cloudy and somewhat viscous. The cell count was 17,500 neutrophils. Gram stain of a smear showed many large gram-positive cocci with irregular arrangement, resembling staphylococci. On culture small colorless nonhemolytic colonies of pleomorphic gram-positive cocci in pairs and short chains were obtained which grew fairly well under anaerobic conditions.

Sulfadiazine was administered, 1 Gm. each four hours, and an ice pack was applied to the head. Pantopon (a mixture of hydrochlorides of opium alkaloids) ⅓ grain (0.022 Gm.), was given to quiet the patient, who by now was somewhat delirious. An intravenous injection of dextrose and saline solution was given twice

Presented at the meeting of the Los Angeles County Medical Society, Aug. 19, 1942.

1. Gissane, W., and Rank, B. K.: Post-Traumatic Cerebrospinal Rhinorrhoea with Case Report, Brit. J. Surg. **27**:717-722 (April) 1940. Wessels, A.: Report of a Case of Spontaneous Cerebrospinal Rhinorrhea with Operative Cure, Ann. Otol., Rhin. & Laryng. **48**:528-530 (June) 1939.

daily, as the patient could not retain food or fluids. Some of the medicine was vomited but not much when no water was given by mouth.

The second day urinary retention developed, so catheterization was carried out each eight hours. The outcome of the illness seemed doubtful for three days, as the patient continued restless and somewhat delirious. After the third day there began to be slight improvement, so that the intravenous injection of fluids was discontinued on the fifth day, and the patient began to eat and take fluids satisfactorily.

On April 1 the spinal tap was repeated, and the cell count was 71 per cubic millimeter. The fluid was cultured and no growth obtained. By this time it was noted that there was no more clear fluid draining from the patient's nose or into his throat. Two days later a third spinal tap was done and clear fluid obtained. The cell count was 7 per cubic millimeter. The pressure was 170 mm. of water. Treatment was discontinued and the patient sent home. He rapidly recovered hearing in the right ear and stated that the pain and the numbness were gone; the facial muscles on the right began to function. He was observed for about one month, and then he was evacuated to a concentration camp, so that it was no longer possible to keep in touch with him. By that time he was doing his regular work as a barber.

CASE 2.—Mr. G. H., a white man about 30 years of age, was admitted to Loma Linda Sanitarium and Hospital by transfer from the Los Angeles County Hospital, on June 22, 1942. Two days previously he had met with an automobile accident. Falling asleep while driving a car, he ran into a stump and stopped so suddenly that his nose and face were fractured against the instrument panel of the automobile.

It was thought advisable to reduce the deformity of the nose by lifting it forward into position under local anesthesia. When this was done, however, the patient showed evidences of considerable shock, and the procedure was abandoned. Subsequent roentgen studies, as well as physical examinations, revealed comminuted fractures of the maxilla, the nasal bones, the zygoma on both sides, and the mandible, with loss of upper and lower incisors.

After the patient was returned to bed, he complained of a clear salty fluid running at intervals from his right nostril. A severe headache then developed, which gradually merged into a stupor. A spinal tap was done the following day, and the fluid ran over the top of the manometer, so that its exact pressure could not be determined. About 10 cc. of it was allowed to escape, which brought the pressure to 200 mm. of water. The fluid was analyzed and found to contain many cells and also a large number of gram-positive pneumococci in pairs and short chains. Typing showed the organisms were type 31 pneumococci.

His blood count was 3,500,000 red blood cells, with hemoglobin 60 per cent, and 19,050 white blood cells, with lymphocytes 12 per cent, monocytes 5 per cent, neutrophils 83 per cent and stab cells 15 per cent.

The patient was now given (1) sulfadiazine (1.5 Gm. to start and 1 Gm. every four hours thereafter), (2) antipneumococcus serum (50,000 units type 31 intravenously and (3) adequate water (he was urged to take 2,500 cc. or more daily).

Treatment was instituted on June 23. The patient continued gravely ill until June 25 (two days) and then began to improve rapidly. His restlessness ceased. He became rational and on June 27 began to want to go home. The administration of sulfadiazine was continued until July 1—in all, just one week. A spinal tap was done on that day, and the cell count was 5; the cerebrospinal fluid was clear; the pressure was 150 mm. of water. There was no nasal drainage, and the patient was discharged at his own insistence on July 2.

He was seen September 2, complaining of a sore throat; on the second day this was much improved, so he went home. There was no drainage from his nose, and he seemed none the worse for his experience with the pneumococcic meningitis.

CONCLUSION

Trauma, operative or accidental, to the head or the face may be complicated with escape of cerebrospinal fluid through the nose. This condition invites infection of the meninges by any organism which may be present in the nasal passages. Heroic administration of the appropriate sulfonamide compound, together with adequate administration of water and an antiserum, if obtainable, constitutes good therapy in such a case.

Loma Linda Sanitarium and Hospital.

Clinical Notes; New Instruments and Technics

A NEW NASOPHARYNGEAL RADIUM APPLICATOR

M. William Clift, M.D., Flint, Mich.

Crowe and Baylor[1] first described the treatment of middle ear deafness due to lymphoid vegetation of the eustachian tube in 1939. The results which they reported at that time focused attention on the radiation treatment of middle ear deafness, particularly that in children. In their work they made use of radon. There are certain disadvantages in the use of radon that are at once apparent. Owing to the fact that there are comparatively few emanation plants in the country, the average otologist will have to plan the time for the treatment of the patient well in advance, and when the radon arrives from the nearest source he will have to compute its value in millicuries. This is due to the fact that radon loses its potency completely in slightly over five days.

Radium element therefore appears to be the best for this treatment, because of its stability. Roentgen rays have likewise been used successfully but have the disadvantage that their application cannot be localized as can the radiation from a radium applicator placed directly on the orifice of the eustachian tube. Farrior and Richardson[2] described a nasopharyngeal applicator in May 1942. This consists of a brass capsule with a wall thickness of 0.5 mm. and an internal diameter such that it is capable of holding five 10 mg. platinum needles. To the capsule is attached a long flexible copper wire. When the capsule is being inserted it is bent slightly to the temporal side. To retain it in position, the wire emerging from the nostril is bent and strapped by adhesive tape to the side of the face.

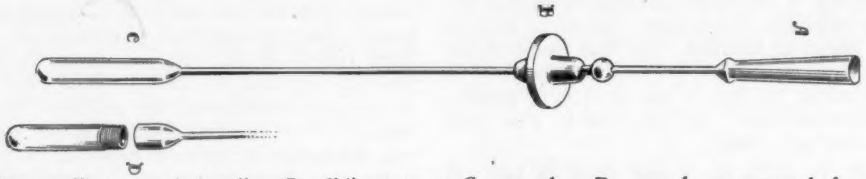

Fig. 1.—The applicator: *A*, handle; *B*, sliding stop; *C*, capsule; *D*, capsule unscrewed for reception of radium needles.

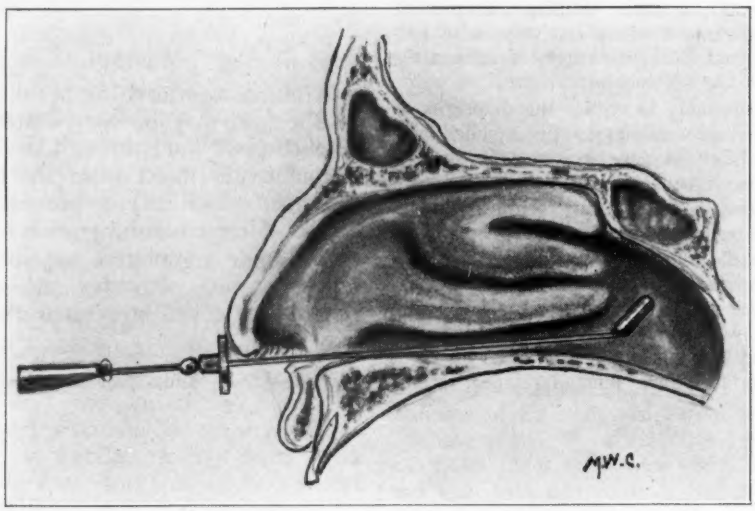

Fig. 2.—Cross section of the nasopharynx showing the applicator in place.

In June 1942 Emerson, Dowdy and Heatly[3] described an applicator, also using radium needles, with fixed angulation of the chamber and an oval window on one side. "This window permits the use of radium without additional filter other than the wall of the needle." With this applicator 35 per cent of the radiation is beta rays.

From Hurley Hospital.

1. Crowe, S. J., and Baylor, J. W.: Prevention of Deafness, J. A. M. A. **112**:585-590 (Feb. 18) 1939.

2. Farrior, J. B., and Richardson, G. A.: The Nasopharyngeal Radium Applicator, Arch. Otolaryng. **35**:811-812 (May) 1942.

3. Emerson, E. B., Jr.; Dowdy, A. H., and Heatly, C. A.: Use of Radium in Treatment of Deafness by Irradiation, Arch. Otolaryng. **35**:845-852 (June) 1942.

Farrior[4] in May 1943 described the histopathologic considerations in the treatment of the eustachian tube. He stated: "There is no lymphoid tissue in or about the normal eustachian tube. However, with chronic disease of the nose, nasopharynx and eustachian tube, lymphoid nodules may appear anywhere in the subepithelial tissue. These nodules are most frequently observed in the inferior aspect of the pharyngeal orifice of the tube and over the torus tubarius. However, they have been noted high within the lumen of the tube and even within the middle ear itself. These lymphoid nodules may act as a mechanical factor in obstructing the lumen of the eustachian tube."

I have used the technic followed by Dr. A. C. Furstenburg, of the University of Michigan; that is to say, 50 milligram hours of radium with filtration through 0.5 mm. of brass. In the earlier cases I used the applicators described by Farrior and Richardson. In general these applicators served the purpose but presented some minor defects which I felt could be easily obviated. It was found that it was difficult to remove the applicators without a certain amount of trauma—an important item with children, particularly if there is need for a subsequent treatment. Also with this type of applicator or others so far described there is no index whereby one can determine whether or not the radium capsule is being maintained in position.

In this article I describe a new applicator which eliminates some of these undesirable characteristics. It has been used now for a number of months with most satisfactory results. The technic of insertion and withdrawal is much simplified.

The accompanying illustrations show (fig. 1) the general characteristics and (fig. 2) the position of the applicator when in place. Its overall length is 6½ inches (16.5 cm.). It consists of four parts: a brass capsule (*C*), which is capable of holding five 10 mg. needles or a 50 mg. capsule of radium; a shaft of silver wire; a handle (*A*) 1 inch (2.5 cm.) in length with one surface flattened; a sliding stop (*B*) which automatically locks at any position desired. This stop consists of a metal disk united to an ordinary tie pin clasp. When the applicator is inserted and the capsule rests in the proper position, the stop is moved along the shaft until it rests against the nose, where it locks. It is held in place by a strip of adhesive tape, and if by any chance there should be a tendency for the applicator to slip out as in a recent case of mine, because of slipping of the tape, this can be detected immediately. In practice the capsule is angulated slightly to the temporal side, and with the flattening of the handle on one side the position of the capsule can be checked at all times during the application. With this type of applicator it is not necessary to have a flexible shaft. As a matter of fact, this is a distinct disadvantage, as kinks may develop to prevent the smooth operation of the glider stop. In future models therefore it is proposed to make the shaft somewhat larger and have it composed of stainless steel or some other nonflexible material.

4. Farrior, J. B.: Histopathologic Considerations in Treatment of the Eustachian Tube, Arch. Otolaryng. **37**:609-621 (May) **1943.**

SUMMARY

With the new type of nasopharyngeal applicator for irradiation of the eustachian tube the technic of insertion and withdrawal is simplified and discomfort to the patient is minimized.

The proof by Farrior that lymphoid tissue may be distributed throughout the entire eustachian tube makes it desirable that the beta rays be absorbed by adequate filtration.

900 Begole Street.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

PERORAL ENDOSCOPY

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ANATOMY OF THE TRACHEOBRONCHIAL TREE

While many valuable studies on the anatomy of the lung are available, there is relatively little found concerning the bronchi, particularly from a bronchoscopic point of view. With increasing interest in bronchoscopy, it is important and necessary that the bronchoscopist, as well as the internist and the thoracic surgeon, should be familiar with those bronchial subdivisions which cannot be visualized endoscopically.

In a study of the subject, Hagens [1] dissected and measured twenty pairs of lungs from cadavers. A résumé of the results is given in the article. He also made some general observations in regard to the blood vessels about the hilar region. A method of utilizing air-inflated human lungs for teaching and demonstration also is included in the presentation. The reader is referred to this paper if a detailed knowledge of measurements is desired.

Jackson and Huber [2] studied the anatomy of the bronchial tree in reference to the branching into lobar and segmental bronchi and the relation of each lobar and segmental bronchus to its corresponding portion of the lung. The nomenclatures used by various writers were discussed and a new one proposed. They have taken as a common basis for the choice of all names the position of the segment in the lobe. The corresponding segmental bronchi were designated by the names of the segments which they supplied. Whenever feasible, use was made of names that had some general acceptance. There is definite need for a standard nomenclature which is acceptable to the clinical group and meets with the approval of the anatomist. The aforenamed authors believe that none of the systems suggested up to this time fulfil these requirements.

1. Hagens, E. W.: Anatomy of the Tracheobronchial Tree from the Bronchoscopic Standpoint: Preparation of Lungs for Demonstration, Arch. Otolaryng. **38**:469 (Nov.) 1943.

2. Jackson, C. L., and Huber, J. F.: Correlated Applied Anatomy of the Bronchial Tree and Lungs with a System of Nomenclature, Dis. of Chest **9**:319 (July-Aug.) 1943.

BRONCHOSPIROMETRY

While the value of bronchospirometry in the study of patients with pulmonary disease has been generally admitted, it has not come into widespread use, because of the impression that the procedure is highly technical and complicated and cannot be performed without the aid of a research laboratory. Steele [3] discusses some of the problems that are met with and also offers a solution for these. He expresses the opinion that valuable clinical results can be obtained in any hospital or sanatorium by determining the consumption of oxygen for each lung separately by simply connecting the ordinary apparatus for determining the basal metabolism to each side of a double channel soft rubber catheter which has been introduced into the tracheobronchial tree.

PREBRONCHOSCOPIC SEDATION

To obtain sufficient cooperation from a patient to permit satisfactory endoscopy without the aid of general anesthesia, Cullen and Trapasso [4] use an extract of curare in connection with topical anesthesia. A preliminary report based on 16 patients on whom 29 procedures were carried out is given. The patients were premedicated and local anesthesia induced in the usual manner. The extract of curare may be given intramuscularly or intravenously. They prefer the intravenous route because of the prompt onset of action, which also permits better estimation of the effects and allows quicker addition of the drug if more is needed.

Curare exerts a selective action. The muscles of the head and the neck are relaxed before paralysis of the respiratory muscles or the muscles of the extremities develops. It possesses no analgesic properties. The authors believe that it has definite advantages over drugs inducing general anesthesia in diagnostic and thera-

3. Steele, J. D.: The Practical Application of Bronchospirometry, Am. Rev. Tuberc. **47**:608 (June) 1943.

4. Cullen, S. C., and Trapasso, A. J.: Use of Curare to Facilitate Endoscopy, Arch. Otolaryng. **38**: 347 (Oct.) 1943.

peutic endoscopic manipulation but that probably it should be used as an aid only with those patients who are difficult to examine.

CONGENITAL ANOMALIES

Constricting double aortic arch in infants, although rare, occurs sufficiently often to warrant reporting additional cases. Herbut and Smith [5] report a case. A child aged 2½ months exhibited respiratory difficulty with paroxysms of coughing, cyanosis and dyspnea. These attacks were usually initiated by feeding and crying. The infant also assumed an unusual posture, namely, rotation of the head to the left. Any change from this position embarrassed the airway, as evidenced by increased dyspnea and cyanosis. Tracheotomy was done but was helpful only in that it allowed removal of accumulated secretion below the constricted area. The authors suggest the possibility of a successful plan of surgical treatment.

Congenital laryngeal stridor has been recognized as an entity for many years, and enlargement of the thymus gland still seems to be considered as the most common cause of the symptoms. In a study of this subject, Trimby [6] was impressed by the apparent confusion of congenital laryngeal stridor with thymic disease. He reports observations in a series of 12 cases.

While congenital laryngeal stridor must be differentiated from other congenital abnormalities which interfere with respiration, also certain acquired conditions, notably foreign body, perilaryngeal abscess, mediastinal tumor, laryngeal spasm and acute infection, it commonly is attributed to and confused with enlargement of the thymus gland. Studies have revealed that simple thymic enlargement is rarely responsible for respiratory embarrassment in children. The pathologic changes in congenital stridor lie in an exaggeration of the infantile type of larynx with abnormal relaxation of the supraglottic structures. While roentgen studies are of value in the examination of these patients, roentgen therapy is without value. An accurate diagnosis can be made only by direct examination.

Diverticulum of a bronchus is rare. When it occurs it probably is demonstrated best by bronchography. In the case reported by Arce [7] the roentgen appearances and the history suggested the probability of hydatid cyst involving the upper lobe of the right lung. At bronchoscopy there appeared on the inner side of the right main bronchus an abnormal bronchial spur in the sagittal plane. In the belief that it could be an aberrant bronchus, the catheter was inserted into the opening and iodized oil injected. While the first films made did not reveal a pouch, later studies showed an accumulation of iodized oil along the inner aspect of the right main bronchus. The shadow previously demonstrated in the upper lobe of the right lung was found at operation to correspond to an incarcerated parasitic membrane. The diverticulum of the right main bronchus was of no clinical importance, but its occurrence should be borne in mind as the possible site of tumor or other lesions.

BRONCHIAL ASTHMA

In a discussion of bronchoscopy in the treatment of bronchial asthma, Gompertz [8] is agreed that it is of value in those patients whose bronchial tree cannot be relieved spontaneously of accumulated secretions. Direct aspiration often is necessary to accomplish this, owing to the fact that the bronchial secretions are excessive or very thick. It will promptly relieve dyspnea and aid in controlling bronchial infection if this is present. Not infrequently one has asthmatic patients who can be maintained in a satisfactory condition by periodic bronchoscopic aspiration. It is of course important that these patients be investigated from the standpoint of allergy and that appropriate treatment be carried out.

Pathologic narrowing of the bronchial lumen coupled with physiologic shortening and contraction of the bronchi probably combine to produce abnormal vibration of the outgoing air during expiration. The resulting sound is often wheezing in character. In a discussion of this subject, Friedberg [9] directs attention to the variety of clinical conditions in which wheezing respiration is observed. This includes practically all lesions which produce narrowing of the airway, and since these cannot be diagnosed by physical and roentgen examination alone, in the majority of instances endoscopic investigation is necessary. Friedberg cites cases of illustrative indications for the diagnostic and therapeutic use of bronchoscopy in simulated asthmatic breathing and is agreed that endoscopic investigation is warranted in any case in which atypical asthma does not respond readily to diagnosis and treatment.

5. Herbut, P. A., and Smith, T. T.: Constricting Double Aortic Arch: Report of a Case, Arch. Otolaryng. **37**:558 (April) 1943.

6. Trimby, R. H.: Congenital Laryngeal Stridor: Lack of Relation to Thymic Diseases, J. A. M. A. **122**: 740 (July 10) 1943.

7. Arce, J.: Diverticulum of the Right Primary Bronchus, J. Thoracic Surg. **12**:638 (Oct.) 1943.

8. Gompertz, J. L.: Bronchoscopy: Its Role in the Treatment of Asthma, California & West Med. **58**:10 (Jan.) 1943.

9. Friedberg, S. A.: Bronchoscopy and Asthmatoid Respiration, J. A. M. A. **123**:85 (Sept. 11) 1943.

BRONCHIAL STENOSIS

Frequency and importance of bronchial stenosis and its diverse nature, which should bring to mind the various etiologic possibilities, are stressed by Cosio Villegas.[10] Stenosis is not necessarily always due to new growth. The evolution of ideas concerning bronchial stenosis has much similiarity to the evolution of the concepts of mitral stenosis held by cardiologists. At first the terms of bronchial ectasia and of mitral insufficiency were employed; then bronchial stenosis and mitral stenosis were recognized, and later the concept was introduced of coexisting lesions of stenosis and ectasia and of stenosis and insufficiency. Cosio Villegas therefore stresses the necessity in a study of bronchial stenosis of having close collaboration between the clinician, the radiologist, the bronchologist and the surgeon.

PULMONARY ATELECTASIS

In his studies on the effects of loss of ciliary function, Hilding[11] was impressed that there were certain pathologic situations in both the upper and the lower respiratory tract which seemingly did not occur unless the cilia were not functioning actively. Among these was postoperative pulmonary atelectasis. After experimental studies in this field he concluded that the steps in the development of postoperative pulmonary atelectasis were as follows: 1. An excess of secretion is formed within the affected lobe. 2. A succession of occluding masses, or pistons, of mucus form across the lumens of the air passages. 3. These pistons move up the cylindric air passages by ciliary action, each carrying a quantity of air. 4. As soon as the pressure within the lobe begins to fall, the organ shrinks by its own elasticity and by pressure from adjacent lobes. 5. The adjacent lobes, carried by the force of inspired air, move into the space relinquished by the affected one. 6. The advancing pistons rupture serially as they reach tubes of greater diameter and meet more forceful changes of air pressure. Each then releases the bubble of air which it carried and continues on its course as a mural mass of film. 7. A negative pressure of considerable proportion is produced within the lobe when the supply of air is exhausted. 8. The masses of secretion then present in the air passages come to a standstill when the cilia can no longer advance them against atmospheric pressure. 9. The cilia continue to remove secretion from these "stalled" masses in thin films and might eventually remove them entirely if they were not replaced by continued secretion. On the basis of these conclusions the treatment of atelectasis seems almost self evident. Prophylaxis must seek to prevent the formation of occluding masses of mucus. All possible measures should be taken to prevent the production of excess secretions. If abnormal quantities form, deep respiration and frequent changes of position will tend to prevent formation of obstructing masses. When atelectasis is present, measures must be taken to replace air in the collapsed lobe. Deep breathing may force air past or through the occluding mass. If this cannot be accomplished, aspiration of the mucus is indicated.

In a discussion of postoperative pulmonary collapse in children following operative procedures, Molony[12] considers the problems of diagnosis, prophylaxis, sequelae and treatment. It is of interest to note that in 15 of the 21 cases which he reports the collapse followed operation on the abdomen, in 4 it followed tonsillectomy and adenoidectomy and in 1 it followed nephrectomy. The commonly employed form of anesthesia was that obtained with ether administered by the open method. In this series there was no relation between the type of anesthesia employed and the time of occurrence of atelectasis. Atelectasis had occurred in all cases by the fifth postoperative day, with the second day as the average for the group. While there probably is no single cause of collapse following surgical operation, bronchial obstruction by thick secretion, hypoventilation, decrease in body tonus, allergy and the employment of a closed system of inducing and maintaining anesthesia must all be considered. While in a number of cases the condition of a conservatively treated patient cleared spontaneously, Molony emphasizes bronchoscopic drainage as the proper treatment in cases of persistent collapse.

A case in which atelectasis occurred following biopsy and again five days later following radical removal of the left breast was reported by Thompson.[13] The anesthesia for the biopsy was of the nitrous oxide–oxygen–ether type. Atelectasis involving the lower lobe of the right lung occurred and was promptly relieved by bronchoscopic aspiration of mucus from the trachea and

10. Cosio Villegas, I.: Contributions to the Study of Bronchial Stenosis, Rev. mex. de tuberc. **5**:165 (Nov.-Dec.) 1943.

11. Hilding, A. C.: The Role of Ciliary Action in Production of Pulmonary Atelectasis, Vacuum in the Paranasal Sinuses, and in Otitis Media, Ann. Otol., Rhin. & Laryng. **52**:816 (Dec.) 1943.

12. Molony, C. J.: Postoperative Pulmonary Collapse in Childhood, Am. J. Dis. Child. **66**:280 (Sept.) 1943.

13. Thompson, H. T.: Recurrent Postoperative Atelectasis: Report of Case, Surgery **14**:866 (Dec.) 1943.

the right main bronchus. Following mastectomy, five days later, performed under intratracheal anesthesia, atelectasis involving the right lung developed again, this in spite of suction of the trachea carried out for the final twenty minutes of the operation to clear the respiratory tract of mucus. The atelectasis was again relieved following removal of thick mucus from the bronchi to the middle and lower lobe of the right lung.

ACUTE LARYNGOTRACHEOBRONCHITIS

In a preliminary report on the employment of hypertonic human plasma for the treatment of obstructive laryngeal and tracheobronchial edema in acute laryngotracheobronchitis, Baum [14] states that the results have been encouraging. The method of administration is simple and safe. If a considerable quantity of plasma is to be administered, it may be desirable to withdraw a moderate amount of blood as a preliminary procedure. Baum emphasizes that concentrated plasma has no effect on the infection or the resulting inflammation, acting only on the edema. It therefore is not indicated in inflammatory conditions of the larynx or the tracheobronchial tree which are not complicated by edema.

In a further report on the treatment of acute laryngotracheobronchitis, Baum [15] points out that although bronchoscopy and tracheotomy have commonly been accepted, they do not always relieve the underlying pathologic conditions.

Tracheotomy for the relief of dyspnea frequently has serious consequences, predisposes to difficulties in the lower respiratory tract and should be avoided if prompt and adequate relief can be obtained without it. He has found that the intravenous administration of hypertonic human plasma often will reduce promptly subglottic edema to the point of comfort and safety. Humidified oxygen is valuable for the relief of respiratory distress and often gives necessary respite while other measures are in preparation or taking effect. Convalescent human serum is best when it is necessary to combat infection in the respiratory mucous membranes.

While no statistical data are given, in Baum's experience the results of nonsurgical treatment have been most encouraging. This form of management should be employed as promptly as possible. If the nonsurgical measures fail, surgical treatment can be resorted to, but the nonsurgical aids will be found equally effective and valueable as adjuncts to surgical treatment.

BRONCHOSCOPY IN DEALING WITH POISON GAS

In a discussion of the treatment of victims of poison gas in warfare, Mitchell [16] propounds the question whether bronchoscopy would be of value. There is considerable question whether the edema can be successfully combated by bronchoscopic intubation and insufflation of oxygen. If this were the only problem involved, bronchoscopy would be the procedure of choice. This subject must be borne in mind, and since gas may be employed in the present conflict, it is the obligation of the medical profession to learn as much as possible about all phases of the problem and assume initiative and leadership.

PULMONARY ABSCESS

The role of the bronchoscopist in cases of pulmonary infection consists of collaboration with the internist, the radiologist and the surgeon. Lanza Castelli [17] emphasized its importance as a diagnostic aid not only to localize the source of the pus but especially to determine the condition of the bronchial tree with regard to any obstruction which might interfere with drainage. He directed attention to the beneficial effects of bronchoscopic aspiration in recent cases and the advantages of direct instillation into the areas of suppuration of medicaments, notably sulfonamide compounds.

BRONCHIECTASIS

Riggins [18] is agreed that diagnostic bronchoscopy is indicated in practically all cases in which bronchiectasis is suspected or recognized. With regard to its employment as a therapeutic measure, he also is agreed that it is valuable in dealing with patients whose bronchi contain foreign bodies, obstructing granulation tissue, benign tumors or other forms of occlusion of a bronchus. For the uncomplicated, unobstructed type of bronchiectasis it is difficult to visualize the therapeutic value of bronchoscopic aspiration, and lavage with the various so-called bactericidal agents, advocated by some bronchoscopists, is considered useless and dangerous. The injec-

14. Baum, H. L.: Acute Laryngotracheobronchitis: Treatment of the Obstructive Laryngeal and Tracheobronchial Edema with Hypertonic Human Plasma; a Preliminary Report, Laryngoscope **53**:371 (June) 1943.

15. Baum, H. L.: Nonsurgical Aspects of Treatment of Acute Laryngotracheobronchitis, Ann. Otol., Rhin. & Laryng. **52**:608 (Sept.) 1943.

16. Mitchell, H. E.: Treatment of Victims of Poison Gas with Special Reference to the Use of the Bronchoscope, Arch. Otolaryng. **37**:371 (March) 1943.

17. Lanza Castelli, R.: Bronchoscopy in Pulmonary Abscess, Rev. méd. de Córdoba **31**:497 (Nov.) 1943.

18. Riggins, H. M.: Present Concepts of Pathogenesis, Morbidity, Mortality and Treatment of Bronchiectasis, Dis. of Chest **9**:5 (Jan.-Feb.) 1943.

tion of bactericidal solutions into the bronchi increases the quantity and liquidity of the infectious secretions and enhances spilling over of these secretions into relatively uninvolved portions of the lung. Cases in which a severe febrile reaction with extension of pulmonary infection followed bronchoscopic lavage with this agent have been recorded. He considers that such treatments are definitely dangerous and should be discouraged. Bronchoscopic treatment does not result in cure of bronchiectasis. At best it may result in symptomatic and temporary improvement.

In a discussion of the interrelationship of infections of the upper and lower respiratory tracts, McLaurin [19] concludes that in from 85 to 100 per cent of the cases chronic bronchitis, bilateral bronchiectasis and peribronchitis are due to infection in the upper respiratory passages, which in nearly every instance is found in the nose. In practically all cases of unilateral bronchiectasis not resulting from a foreign body, a tumor or a specific lesion is preceded by atelectasis occurring in infancy or childhood, and this can practically always be diagnosed roentgenologically. There may be a few cases in which bilateral bronchiectasis can be explained pathogenically by atelectasis in childhood.

The simultaneous occurrence of infections in different parts of the respiratory tract is commonly observed. Simonton [20] found in reviewing the literature that bronchiectasis may be the result of chronic sinusitis or the two infections may arise simultaneously as the sequel of severe acute infection of the entire respiratory tract. Experimental and clinical evidence demonstrated the transfer of secretions from one part of the respiratory tract to another. The incidence of sinusitis among patients who had bronchiectasis was found to be much higher than the incidence of bronchiectasis among patients who had chronic sinusitis. He observed that the treatment of chronic sinusitis in the presence of bronchiectasis was unsatisfactory because of reinfection of the sinuses by secretions expelled from the lungs during coughing and concludes that when both sinusitis and bronchiectasis are present surgical treatment of the sinuses should be deferred until after the diseased lung has received appropriate surgical treatment.

Goodale [21] studied the results of operation on the paranasal sinuses in a group of 75 cases in which bronchiectasis complicated sinusitis, in order to determine the value of such treatment in the management of the bronchiectasis.

Two criteria in estimating the postoperative improvement in the patient's health were considered, namely, the local effect in the nose and sinuses and the effect on the pulmonary symptoms. He believes that untreated sinusitis was a definite hindrance to recovery from the thoracic infection and that the best results were obtained in those cases in which there was no complicating sinusitis. In cases in which the sinuses were operated on but lobectomy was not done, the results were poor. The best results were obtained when adequate operation on the sinuses and lobectomy could be performed, and he believes that these two procedures are indicated in all suitable cases.

Bronchiectasis is not bronchiectasis from the start. In childhood, according to Brennemann,[22] it represents evolution from a prebronchiectatic state that is commonly recognizable and as commonly curable. Bronchiectasis is nearly always preceded by atelectasis, and atelectasis occurs whenever there is complete bronchial obstruction. Much of the bronchiectasis can be prevented by early recognition of atelectasis and cure of it through relief of bronchial obstruction. The removal of foreign bodies, the bronchoscopic aspiration of obstructing secretions and postural drainage are all indicated as preventive measures. Surgical removal of the diseased lobe or lung offers the only certainty of cure for established bronchiectasis.

The most common cause of bronchiectasis is a disease process which hinges on atelectasis, according to Anspach.[23] This is most often recognizable in an early stage by the triangular shadow of increased density at the base of one or both lungs. If this shadow can be dissipated, bronchiectasis can be prevented. Most bronchiectasis of the lower lobe can be traced to childhood and in by far the majority of cases it occurs during the first two years of life. There is no proof that "congenital cystic disease" has a different origin or that the changes occurred in prenatal life. There is no reason to suspect that the bronchial dilatation associated with a tuberculous lesion is dependent on any special char-

19. McLaurin, J. G.: Interrelationship of Upper and Lower Respiratory Infections, Emphasizing the Routes of Infection, Ann. Otol., Rhin. & Laryng. **52**:589 (Sept.) 1943.

20. Simonton, K. M.: Observations on Paranasal Sinusitis Among Patients Subjected to Lobectomy for Bronchiectasis, Ann. Otol., Rhin. & Laryng. **52**:598 (Sept.) 1943.

21. Goodale, R. L.: Effect of Surgical Treatment of the Sinuses on Bronchiectasis: Analysis of Results in Seventy-Five Cases, Arch. Otolaryng. **38**:148 (Aug.) 1943.

22. Brennemann, J.: Bronchiectasis as a Pediatrician Sees It, Dis. of Chest **9**:39 (Jan.-Feb.) 1943.

23. Anspach, W. E.: Roentgenologic Aspects of Bronchiectasis, Dis. of Chest **9**:24 (Jan.-Feb.) 1943.

acteristics of the tubercle bacillus or that its pathogenesis is different from that of other bronchiectasis. The change from the normal state of the lung to various forms of bronchial dilatation can be readily observed on regular roentgenograms of the chest or bronchograms made at fairly frequent intervals. Roentgen examination is necessary for positive identification of bronchiectasis and for early recognition of the atelectasis which precedes bronchiectasis.

In a discussion of the bronchoscopic aspects of bronchiectasis Clerf [24] states that the bronchoscopic findings in this condition vary. In dry bronchiectasis nothing abnormal may be noted bronchoscopically. In the infected form purulent secretion, inflammatory changes or bronchial obstruction may be observed. However, the final diagnosis is based on a roentgen study of the bronchial tree following instillation of iodized oil by one of the various methods described.

Considerable stress is laid on the importance of bronchoscopy as an aid in preventing bronchiectasis by the relief of bronchial obstruction. Bronchoscopic aspiration of secretions from infected areas aids patients who are too old for surgical intervention or who have bilateral lesions which render surgical treatment impracticable.

SULFONAMIDE COMPOUNDS IN THERAPY FOR BRONCHIECTASIS

Stacey [25] found that the oral administration of sulfonamide compounds over a period of months failed to control the acute infections or lessen the toxic symptoms in patients with bronchiectasis, and in addition there developed an increasing intolerance to these drugs. He therefore developed a method of inhalation of nebulized solutions of sulfonamide compounds. A 5 per cent solution of sodium sulfathiazole was employed. One cubic centimeter was placed in a nebulizer which was connected by a rubber tube to an oxygen tank equipped with a flow meter. The patient held the nebulizer between the teeth and by slowly inhaling the nebulized solution was able to dispose of about 1 cc. of solution in twenty to thirty minutes. This method of treatment was found to leave the air passages entirely free from local irritation, and the amount of drug absorbed systemically was too small to be measurable. He expresses the opinion that distinct benefit was secured in a small series of cases of bronchiectasis and that the method is worthy of further study.

With the general employement of sulfonamide compounds in infections, clinical studies have been carried out with these in the treatment of bronchopulmonary infections. Latraverse [26] reports his experiences with the use of sulfathiazole solution. He states that sulfathiazole sodium in 5 per cent solution appeared superior to mercuric antiseptic solutions. It seemed to have practically no irritative effect on the bronchial mucosa and its bactericidal and bacteriostatic action appeared to favor regeneration of inflamed mucous membrane and check formation of mucopus in cavities. In bronchoscopic treatments for suppuration Latraverse instilled 10 to 20 cc. of sulfathiazole sodium in 5 per cent solution, and a part of this was then aspirated. This was repeated in several days if there was a large quantity of secretion. He also employed the drug by laryngoscopic instillation, using from 2 to 5 cc. He expresses the opinion that this form of medication has exerted a favorable influence on the course of bronchopulmonary suppurations.

In recent literature there are few references to the use of sulfonamide compounds in the treatment of chronic pulmonary suppuration. In a study of the effects of these drugs Norris [27] wished to determine first the correlation between the concentration of sulfonamide compounds in the blood following oral administration and their concentration in bronchial secretion and, second, the concentration in bronchial secretion resulting from intratracheal or intrabronchial instillation of sulfonamide compounds at twenty-four hour intervals after the instillation. In a series of 12 cases in which sulfadiazine was administered by mouth in doses to maintain adequate blood levels, specimens of bronchial secretion obtained by bronchoscope at intervals of from one to four days revealed that the concentration in the secretion was approximately 60 per cent of that in the blood. This ratio apparently is not affected by the extent of bronchial disease or the amount of expectoration.

After intratracheal or intrabronchial instillation of a 5 per cent aqueous suspension of microcrystalline sulfathiazole a significant concentration persisted in the bronchial secretions for twenty-four to forty-eight hours. The elimination of a 2.5 per cent aqueous solution of sulfa-

24. Clerf, L. H.: Bronchoscopy in Bronchiectasis, Dis. of Chest **9**:56 (Jan.-Feb.) 1943.

25. Stacey, J. W.: The Inhalation of Nebulized Solutions of Sulfonamides in the Treatment of Bronchiectasis, Dis. of Chest **9**:302 (July-Aug.) 1943.

26. Latraverse, V.: Bronchopulmonary Suppurations Treated with Instilled Sulfathiazole Solution, Canad. M. A. J. **49**:290 (Oct.) 1943.

27. Norris, C. M.: Sulfonamides in Bronchial Secretion: The Effect of Sulfonamides in Bronchiectasis, J. A. M. A. **123**:667 (Nov. 13) 1943.

diazine that had been instilled into the tracheobronchial tree appeared to be much more rapid, the amounts remaining at the end of twenty-four hours being negligible. Norris found that a combination of treatment with sulfonamide compounds and bronchoscopic therapy in 10 cases of acquired bronchiectasis resulted in considerable reduction in the daily volume of sputum with favorable alteration in the bacterial flora. He believes that this plan of treatment should prove of value as a preliminary to lobectomy or pneumonectomy for suppurative disease. It is probably worthy of trial in cases of well established nonsurgical bronchiectasis.

The disabling economic and psychologic effects of bronchiectasis and purulent bronchitis are well known. In discussing the problem of nontuberculous pulmonary infections and methods to provide relief for the patient so afflicted, Stitt [28] describes in detail his method of bronchial lavage. Various medicaments that have been employed and the results secured are presented. His results indicate that although complete anatomic cures cannot be obtained, since the cavities in bronchiectasis can never be eliminated except by surgical treatment, definite improvement has resulted in a large number of cases. Symptomatic cures have been obtained in about 30 per cent and symptomatic relief in about 50 per cent. In only 20 per cent was there no improvement.

PULMONARY ASPERGILLOSIS

A fatal case of aspergillosis of the lungs is reported by Hetherington.[29] The patient, aged 33 years, gave no history of exposure, and the earlier symptoms and signs suggested pulmonary tuberculosis. Aspergillus niger was obtained on culture of sputum, and a diagnosis of primary aspergillosis of the lungs was made. The infection resisted all plans of treatment, and the patient ultimately succumbed. Autopsy studies of the lungs were made, and the anatomic diagnosis was aspergillosis.

A successful response to iodine administered orally and intratracheally in a case of primary bronchial actinomycosis is reported by McHardy and Browne.[30] Productive cough, repeated hemoptysis, fever, loss of weight, dyspnea, pain in the chest and cachexia are common manifestations of the disease. Bronchoscopic removal of secretions and tissue for study is of value in cases of bronchial involvement.

HISTOPLASMOSIS

A case of histoplasmosis reported by Van Pernis, Benson and Holinger [31] is of interest because the patient's complaints, consisting of irritation, hoarseness and difficulty in swallowing, were referred to the larynx and the pharynx. The diagnosis was made by biopsy of the laryngeal lesion, which appeared as a verrucous mass extending across the posterior commissure and spreading laterally into the ventricles and the posterior portions of the ventricular bands. The case terminated fatally. The observations at autopsy indicated that there was systemic involvement. A detailed report of the case, the postmortem observations and the results of animal and cultural studies is made.

TUBERCULOUS TRACHEOBRONCHITIS

The report of Meneghello and Smith,[32] who examined 15 infants and children with obstructive emphysema and atelectasis occurring in the course of tuberculosis, is of interest. A majority of the patients appeared to be in surprisingly good physical condition. Of the 9 examined bronchoscopically, 3 showed constriction of a bronchus due to pressure from without; 3, tuberculous granulation tissue with more or less exudate, and 1, a culmination of the two bronchial conditions. In another patient the bronchial involvement was complicated by a foreign body (nut) embedded in the tuberculous granulations. In only a single case did bronchoscopic examination give a negative result. Five of the children were not examined bronchoscopically because their condition showed favorable progress roentgenologically. The authors, however, recommend bronchoscopic examination in all cases. In 1 of the 7 cases in which the bronchial involvement could be followed sufficiently long it led to questionable evidence of bronchiectasis.

No definite therapy was carried out other than removal of the child from the tuberculous contact. There was one fatality from miliary tuberculosis and tuberculous meningitis in the series; it occurred in the patient whose bronchial involvement was complicated by a foreign body. It is concluded that if the tuberculous infant

28. Stitt, H. L.: Bronchial Lavage in Nontuberculous Infections, Ann. Otol., Rhin. & Laryng. **52**: 477 (June) 1943.

29. Hetherington, L. H.: Primary Aspergillosis of the Lungs, Am. Rev. Tuberc. **47**:107 (Jan.) 1943.

30. McHardy, G., and Browne, D. C.: Primary Bronchial Actinomycosis, South. M. J. **36**:674 (Oct.) 1943.

31. Van Pernis, P. A.; Benson, M. E., and Holinger, P. H.: Laryngeal and Systemic Histoplasmosis (Darling), Ann. Int. Med. **18**:384 (March) 1943.

32. Meneghello, J., and Smith, C. A.: Obstructive Emphysema and Atelectasis in Tuberculosis of Infants and Children, J. Pediat. **22**:265 (March) 1943.

is alive within twelve to eighteen months, the likelihood of a fatal termination is nil.

In a discussion of certain aspects of tuberculous tracheobronchitis, McCullough [33] agrees with other observers that this complication is observed in about 11 per cent of cases. He emphasizes the importance of wheezing respiration, paroxysmal cough and asthma-like attacks among the important symptoms. The common roentgen findings are those of atelectasis and check valve or balloon cavity with a fluid level. While a positive diagnosis can be made with certainty only by bronchoscopy, a negative result of bronchoscopic examination does not eliminate the possibility of disease of the smaller bronchi.

If ulceration is present, local treatment with 30 per cent silver nitrate seems to be beneficial. For cases in which the tracheobronchial disease is complicated by stenosis, local treatment through the bronchoscope may often be necessary; as a rule, however, thoracoplasty is ultimately the procedure of choice. Aspiration and drainage of blocked cavities may be indicated before, during and after thoracoplasty.

In a review of approximately 100 bronchoscopic examinations of patients with pulmonary tuberculosis, Rodríguez [34] evaluates the indications for bronchoscopy. Of all indications, he considers persistent hemoptysis which cannot be explained clinically as the most important. While hemoptysis is not uncommon in pulmonary tuberculosis, internists must bear in mind that it also is a symptom of bronchiectasis, cancer, pulmonary mycosis, pulmonary abscess and syphilis. In addition, bleeding may occur in the upper air or food passages, and this can be readily confused with blood coming from the tracheobronchial tree. Other indications for bronchoscopy are finding of tubercle bacilli in the sputum and gastric contents without demonstrable pulmonary evidence of tuberculous lesions, atelectasis after transient pulmonary collapse, inability to collapse a pulmonary cavity and clinical evidences of tuberculous bronchitis. While biopsy is a necessity in the diagnosis of carcinoma, precautions should be taken if there is a question of tuberculosis, particularly if there is extensive infiltration.

In discussing the treatment of tuberculous lesions of the trachea and bronchi, Davies [35] states that a review of the literature reveals that there are many who believe local treatment of these lesions to be useless whereas others believe that it has definite value. Considerable question also exists as to the best plan of therapy, some advocating the employment of cauterization with silver nitrate or other agents, while others believe that all such agents are harmful in that they produce excessive scarring and stenosis of the bronchus.

He believes that bronchoscopy itself is harmless in tuberculous patients with or without tracheobronchial lesions provided a proper technic is employed and contraindications are respected. In a series of approximately 400 bronchoscopic examinations in 156 patients he saw no evidence of harm in a single case. He prefers a 30 per cent solution of silver nitrate, believing that this does not increase the amount of scar tissue over that which would be normally laid down if the lesion healed spontaneously.

The following program is suggested as a tentative but reasonable basis for the treatment of patients with tuberculous tracheobronchitis: complete rest in bed in a sanatorium and a diet adequate in all essentials; relief of symptoms by a warm, humid atmosphere, adequate intake of fluids, postural drainage and the use of expectorants, antispasmodics and barbiturates as necessary; persistent bronchoscopic cauterization of all accessible ulcerated lesions at biweekly intervals, preferably with a 30 per cent solution of silver nitrate; use of collapse therapy if the parenchymal lesion by itself demands collapse or if a main or lobar bronchus is seriously obstructed and if the obstruction cannot be promptly relieved. If collapse is indicated, complete thoracoplasty is usually the procedure of choice. In a few exceptional cases lobectomy, pneumonectomy or open cavity drainage may be used when more conservative measures have failed.

The interest in tuberculous tracheobronchitis, with the information secured by bronchoscopic investigation, has suggested to many that a routine bronchoscopic examination should be made on every patient admitted to a sanatorium. Others have a more conservative attitude and limit bronchoscopic investigation to patients whose condition is amenable to collapse therapy. The accumulation of more clinical data pertaining to this subject has resulted in the acceptance of certain general indications for bronchoscopy in tuberculous patients. These are summarized as follows: intermittent or unexplained atelectasis; wheeze; persistence of tubercle bacilli in the sputum which is inconsistent with the clinical and the roentgenologic course; marked variations in the daily volume of sputum; unexplained hemoptysis. It is also indicated as a routine

33. McCullough, D.: Tuberculous Tracheobronchitis, Dis. of Chest **9**:448 (Sept.-Oct.) 1943.

34. Rodriguez, D. M.: The Value of Bronchoscopy in the Study of Bronchopulmonary Tuberculosis, Rev. de otorrinolaring. **3**:77 (Sept.) 1943.

35. Davies, R.: Treatment of Tuberculous Tracheobronchitis, Am. Rev. Tuberc. **48**:94 (Aug.) 1943.

procedure prior to thoracoplasty and as a means of determining the source of sputum containing tubercle bacilli in the absence of roentgenologically demonstrable parenchymal lesions. It is believed by many that routine bronchoscopy is not necessary and offers little information over that obtained from the bronchoscopic examination only of patients who have presented one or more of the aforementioned indications.

In a study of postbronchoscopic reactions Radner [36] collected data on 183 cases in which the examinations were made on patients with pulmonary tuberculosis. In 18 cases there was postbronchoscopic fever, which appeared to be of little significance, and in 26 there was a secondary rise in temperature, appearing between the tenth and the sixteenth postbronchoscopic day and lasting two to three weeks. In 21 there was a minimal infiltrative spread, as shown on roentgen films, and in 5 the bronchoscopic examination was followed by atelectasis of a lobe or a lung. He suggests that patients subjected to bronchoscopy prior to thoracoplasty should defer any surgical intervention for at least three weeks and that the interval between bronchoscopic examinations or treatments should not be less than six to eight weeks to allow for subsidence of any reaction resulting from previous treatment.

While bronchiectasis is found at autopsy in a high proportion of cases of tuberculosis, it does not appear to play any recognizable part in the picture of tuberculous disease. In a study of the subject Rilance and Gerstl [37] examined a series of 47 patients with significant degrees of bronchiectasis in association with tuberculosis. Twelve of these patients came to autopsy, and 35 were studied by bronchography. The clinical picture and the appearances of the roentgen films demonstrated the marked similarity that sometimes exists between the manifestations of tuberculous bronchiectasis and those due to active pulmonary tuberculosis. The symptoms of suppurative bronchiectasis secondary to pulmonary tuberculosis so closely simulate those of active tuberculosis that errors in their differentiation may readily be made.

In tuberculous bronchiectasis there are marked distortion and abnormal angulation of bronchi, changes not usually found in connection with nontuberculous bronchiectasis. Cystic bronchiectatic cavities located in the shrunken upper lobe appear to simulate roentgenographically in every respect chronic tuberculous cavities and in reality may be reepithelized tuberculous cavities.

TRACHEAL ONCOCYTOMA

Oncocytoma of the trachea in a patient treated for several years as a patient with asthma is reported by Palmer.[38] The symptoms suggested an obstructive lesion in the airway; there was wheezing, and breathing appeared to be of the obstructive type, with prolongation of both the inspiratory and the expiratory phase. The diagnosis was made by bronchoscopy. Repeated bronchoscopic examinations were performed with partial removal of the growth by means of punch forceps and surgical diathermy. There was temporary relief from symptoms. No evidence of metastasis was observed. Palmer emphasizes the importance of bronchoscopy for the patient with an asthmatic wheeze audible at the open mouth, to eliminate the possibility of the presence of an obstructing tumor causing symptoms resembling asthma.

BRONCHIAL CARCINOMA

In a review of the role of the bronchologist in the diagnosis and the treatment of diseases of the bronchopulmonary tract, Penta [39] emphasizes the importance of bronchoscopy as a diagnostic aid in cases of primary carcinoma of the lung. His experience corroborates that of other observers, namely, that a positive bronchoscopic diagnosis can be made in about 75 per cent of cases. Emphasis also is placed on the recognition and removal of bronchial obstruction to prevent the development of atelectasis and pulmonary suppuration. He urged close cooperation between the internist, the roentgenologist and the bronchologist to facilitate the diagnosis of obscure bronchopulmonary conditions.

The case reported by Field and Quilliam [40] suggests a real as well as an apparent increase in the incidence of bronchial carcinoma. A series of 5 cases in the age group from birth to 9 years covers the literature from 1875. Bronchoscopy was not performed, the diagnosis being made from study of tumor cells in aspirated pleural fluid coupled with biopsy of a pleural nodule seen thoracoscopically. The duration of the illness was two and a half months. Necropsy

36. Radner, D. B.: Postbronchoscopic Reactions in Pulmonary Tuberculosis, Am. Rev. Tuberc. **47**:370 (April) 1943.

37. Rilance, A. B., and Gerstl, B.: Bronchiectasis Secondary to Pulmonary Tuberculosis, Am. Rev. Tuberc. **48**:8 (July) 1943.

38. Palmer, A.: Oncocytoma of the Trachea, Laryngoscope **53**:377 (June) 1943.

39. Penta, A. Q.: The Role of the Bronchologist in the Diagnosis and Treatment of Diseases of the Bronchial Pulmonary Tract, New York State J. Med. **43**:10 (May 15) 1943.

40. Field, C. E., and Quilliam, J. P.: Primary Bronchial Carcinoma at Age of Four Years, Four Months, Brit. M. J. **1**:691 (June 5) 1943.

evealed an anaplastic carcinoma of the bronchus with extensive pleural involvement and metastasis to the regional lymph nodes.

During the past decade there has been marked progress in successful treatment of carcinoma of the lungs, but unfortunately there has not been a comparable advance in prompt and early diagnosis of the disease. In a discussion of this subject Moersch and Tinney [41] point out that if progress in treatment is to continue there must be either early diagnosis or improvement in present diagnostic methods. Since carcinoma of the lung does not exhibit a typical clinical picture but often simulates other types of pulmonary disease, it is necessary that the diagnostician suspect the possibility of bronchogenic carcinoma in any patient in whom pulmonary symptoms of unexplained cause develop. They are agreed that the early diagnosis of carcinoma can be confirmed most easily and accurately by bronchoscopy. If this procedure were employed more generally and more promptly in cases in which carcinoma is suspected more lesions due to this cause would be found suitable for surgical treatment. In a group of 949 cases studied, bronchoscopy was performed in 636, and 399 (63 per cent) biopsy specimens revealing carcinoma were secured.

Murray [42] expressed the opinion that the incidence of bronchogenic carcinoma has definitely increased. Awareness of this fact should aid greatly in recognizing its occurrence in the earliest stages. Physicians should be aware of cough, wheeze, hemoptysis and pain in the chest that start and endure after 40 years of age, particularly if such symptoms have not occurred before. While radical surgical removal offers the only prospect of cure, it can be effective only if it is employed at the earliest possible time, before metastasis or other fatal complications occur. It is therefore vitally important that the diagnosis be made early. When bronchogenic carcinoma is suspected but not proved, bronchoscopic examination should be considered mandatory.

In a series of 31 proved cases of carcinoma of the lungs reported by Fetter [43] the diagnosis was established by bronchoscopic biopsy in 14, by necropsy in 11, by biopsy of a metastatic lesion in 3, by exploratory thoracotomy in 2 and by finding tumor cells in the pleural fluid in 1. Six patients were considered candidates for exploratory thoracotomy. All proved to have inoperable lesions.

Fetter agrees that the mortality from this disease can be reduced only if carcinoma of the bronchus is constantly kept in mind as a diagnostic possibility and bronchoscopy performed earlier in cases in which it is suspected.

The relationship of carcinoma to chronic irritation has always been of interest. In the case reported by Blake [44] a metallic foreign body which had been present in the bronchus for six years was inadvertently removed at the time that a bronchoscopic biopsy was performed for a suspected carcinoma of the lung. Exploratory thoracotomy revealed an inoperable anaplastic carcinoma of the middle lobe of the right lung. The metallic foreign body apparently was surrounded by cancer tissue, as it was removed in the grasp of the biopsy forceps. It was interesting to note that before removal the object could not be seen on the roentgen film and that after its presence became known it could not be demonstrated, owing to the density of the shadows of the overlying tissues.

Since an apparent increase in the incidence of primary intrathoracic tumors has occurred and since with early recognition the great majority may be cured by radical surgical intervention, the diagnosis and treatment of primary intrathoracic tumors is becoming more and more important. In a review of the practical management of this entire group of tumors, Dolley and Brewer [45] emphasize that the signs and symptoms of bronchial adenoma and those of bronchial carcinoma, which constitute practically all of the primary tumors of the lung, are somewhat similar. The symptoms and signs of adenoma commonly extend over a period of years, while those of carcinoma are present for only a matter of weeks or months before metastasis occurs. The symptoms are due to bronchial irritation and bronchial obstruction. The irritative symptoms are cough or changes in the character of a long-standing cough, with or without expectoration and occasionally hemoptysis. Obstructive symptoms begin with wheezing, followed often by atypical pneumonia with protracted convalescence or abscess of the lung. Bronchiectasis, a common finding with bronchial obstruction, is frequently observed in the presence of adenoma but rarely in that of carcinoma of the bronchus. They emphasize that pain is a late symptom of carcinoma of the bronchus.

41. Moersch, H. J., and Tinney, W. S.: Carcinoma of the Lung, Minnesota Med. **26**:1046 (Dec.) 1943.

42. Murray, F.: Bronchogenic Carcinoma, Dis. of Chest **9**:383 (Sept.-Oct.) 1943.

43. Fetter, F.: Carcinoma of the Lung: A Review of Thirty-One Proved Cases at the Philadelphia Naval Hospital, Ann. Int. Med. **18**:978 (June) 1943.

44. Blake, J. M.: Primary Carcinoma of the Bronchus Associated with Foreign Body, Am. Rev. Tuberc. **47**:109 (Jan.) 1943.

45. Dolley, F. S., and Brewer, L. A.: The Diagnosis and Treatment of Primary Intrathoracic Tumors, J. A. M. A. **121**:1130 (April 3) 1943.

Since about 75 per cent of these tumors arise in portions of the bronchus visible by bronchoscope, the diagnosis can be made in a large group of patients by bronchoscopy on the basis of visualization and biopsy revealing neoplasm. In the peripheral type of bronchogenic carcinoma, which cannot be visualized bronchoscopically, a shadow is present in the portion of the lung fields which is readily observed roentgenologically and appears as that of tumor or pneumonitis distal to secondary bronchial obstruction. These two diagnostic aids, namely, roentgenology and bronchoscopy, should be employed, therefore, in any case in which new growth is suspected.

While it is generally accepted that neoplastic metastases from other parts of the body do not involve bronchi early, a number of cases are known in which metastases in the bronchi were diagnosed during life by bronchoscopy. In a study of 109 necropsies on persons who died of pulmonary metastatic tumor, King and Castleman [46] found that there had been bronchial invasion in 18.3 per cent, or 20. In addition, there were 3 patients with malignant lymphoma who showed bronchial invasion. The incidence of bronchial involvement in cases of sarcoma was much higher than that in cases of carcinoma. Among 11 cases of sarcoma there were 6 with bronchial invasion, a percentage rate of 55.6, while the incidence of bronchial invasion in cases of carcinoma was 14.3 per cent. It is of interest to note that expectoration of blood occurred in only 4 of the 109 cases of metastatic pulmonary neoplasm.

BRONCHIAL ADENOMA

There is considerable difference of opinion regarding the question of malignancy of bronchial adenoma. Anderson [47] reports the observations at autopsy in the case of a tumor of a bronchus which alone would have been considered as a benign bronchial adenoma but which was diagnosed as malignant on the discovery of a metastasis in the liver. He discusses the various theories concerning the origin of bronchial adenoma. This case provided proof that metastases can and do occur, and he therefore suggests that the plan of therapy for bronchial adenoma should be the same as that for other types of cancer.

46. King, D. S., and Castleman, B.: Bronchial Involvement in Metastatic Pulmonary Malignancy, J. Thoracic Surg. **12**:305 (April) 1943.

47. Anderson, W. M.: Bronchial Adenoma with Metastasis to the Liver, J. Thoracic Surg. **12**:351 (April) 1943.

HODGKIN'S DISEASE

Although patients with Hodgkin's disease frequently present signs and symptoms of obstruction in the respiratory system, involvement of submucosal lymphoid tissue of the bronchi with or without the formation of masses in the bronchus itself is less frequently observed. In a case reported by Smith and Shefts [48] bronchoscopic investigation was not carried out, as the patient was too ill. The clinical and roentgen findings suggested a tumor in the hilus of the left lung. At autopsy tissue nodules characteristic of Hodgkin's disease were observed encroaching on the lumen of the left main bronchus, the largest being elevated about 6 mm. above the surrounding mucosa and encircling the lumen in one half of the circumference. The masses of tissue projecting into the bronchial lumen simulated carcinoma.

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES

While a review of the literature reveals only occasional mention of either candy or chewing gum as a foreign body in the tracheobronchial tree, their common use by children, particularly playing children, suggests that these objects should be relatively common. Holinger [49] reports his experiences with 5 patients in whom severe obstruction of the airway was caused by a confection. While the initial symptoms and the early physical signs and roentgen findings were not unlike those associated with other types of foreign bodies, as the candy dissolved obstructive emphysema often was replaced by atelectasis. This differed, appearing as a peculiar patchy density throughout the involved area rather than as the homogeneous density characteristic of postoperative atelectasis. He emphasizes the possibility that in some cases otherwise unexplained atelectasis in childhood may be due to obstruction by hard candy aspirated while the child was playing.

While there are numerous references in the literature to multiple foreign bodies, also to objects of dental origin, in the tracheobronchial tree, the case reported by Womack [50] is unusual in that one tooth was lodged in the bronchus to the upper lobe of the left lung and another in

48. Smith, E. B., and Shefts, L. M.: Hodgkin's Disease: Report of a Case with Involvement of the Bronchi, J. Thoracic Surg. **12**:296 (Feb.) 1943.

49. Holinger, P. H.: Candy and Chewing Gum as Foreign Bodies in the Air Passages, Laryngoscope **53**:312 (May) 1943.

50. Womack, D. R.: A Case of Foreign Body in Each Lung, Laryngoscope **54**:495 (July) 1943.

the bronchus to the middle lobe of the right lung. This occurred following tonsillectomy with the patient under general anesthesia and the head of the operating table lowered.

While considerable difficulty was experienced with the tooth in the bronchus to the upper lobe of the left lung, both were removed without mishap, and the patient made a satisfactory recovery. Womack emphasizes the importance of guarding against this accident in any operation around the oral cavity, even with patients in the Trendelenburg position. In any case in which surgical work around the oral cavity is done, roentgen studies of the chest should be made for possible foreign body if there are any symptoms which are not fully explained as the result of the surgical procedure.

The case reported by Tapia Acuña [51] is interesting in that a tack, a radiopaque object, had been in a bronchus for thirteen years and had been overlooked. Cough and expectoration of foul mucopurulent sputum were present, however, and all examinations for tuberculosis failed to demonstrate its presence. Not until severe hemoptysis had occurred was a roentgen examination of the chest made. This revealed a tack in the left bronchus. The tack was removed at the second bronchoscopic examination, but the lung distal to the foreign body was the seat of extensive suppuration, which ultimately proved fatal.

In a report covering a series of 525 cases of foreign bodies in the air and food passages, Holinger, Andrews and Rigby [52] analyze the age of occurrence, types of foreign bodies encountered, their location and certain etiologic factors. It was of interest to note that safety pins as foreign bodies were most frequently found in children 7 months to 2 years of age, peanuts in children 15 months to 4 years of age, coins in children of 2 to 4 years and chicken bones in adults of 30 to 70 years.

For laryngitis produced either by a foreign body or by attempts at removal, the patients were placed in a "steam room" without waiting for signs of obstruction. The use of sulfonamide compounds to combat the complications of the conditions caused by foreign bodies was found to be of definite value and was routine in this series in cases in which esophageal perforation or pulmonary infection was suspected. In cases of bronchial obstruction unrelieved by removal of the foreign body, reaspiration of the drowned lung was repeatedly carried out when indicated. In no case was it necessary to do tracheotomy.

There was no fatality in the series which could be attributed to the endoscopic removal of the foreign body. Two deaths occurred which could be indirectly attributed to the presence of the foreign body. One occurred eighteen months after extraction of the foreign substance, during an attempt at lobectomy for bronchiectasis which had developed as a result of the presence of the foreign body. The other occurred four weeks after extraction of the foreign body from perforation of the stomach by a gastrostomy tube. The extensive esophageal perforation produced by the foreign body, which made gastrostomy necessary, had completely healed.

Frederick and Verberkmoes [53] report a series of 30 foreign bodies in the air passage of children. In only 3 instances was there a serious pulmonary complication, and the diagnosis of this was made one month, six weeks and two months, respectively, after aspiration of the foreign body. Twenty-one of the 30 foreign bodies reported were vegetal foreign bodies or foods.

Esophageal perforation with mediastinitis as a complication of esophageal foreign body and eventual recovery without mediastinotomy are unusual. In the case reported by Baum [54] mediastinal emphysema with marked laceration of the esophagus and esophageal perforation led to the decision not to remove the foreign body and to defer external drainage. The patient's condition improved on a regimen of noninterference, and at the end of seventeen days it was such that another esophagoscopic exploration was considered justifiable. The foreign body was removed. Subsequent roentgen studies showed no further esophageal leakage, and the convalescence was uneventful. This case demonstrated that sometimes it is possible to withhold mediastinotomy and still achieve a successful result.

ESOPHAGOSCOPY

Although much of present knowledge concerning the function of the cricopharyngeus muscle has been obtained from endoscopic observations, these probably are inadequate to permit exact conclusions. Only the presenting surface, not the entire sphincter, is seen esophagoscopically. In addition the presence of the esophagoscope

51. Tapia Acuña, R.: Foreign Body Remaining in the Bronchi for Thirteen Years; Pulmonary Abscess, Rev. mex. de tuberc. **5**:53 (March-April) 1943.

52. Holinger, P. H.; Andrews, A. H., Jr., and Rigby, R. G.: Foreign Bodies in the Air and Food Passages: Report of a Series of 525 Cases, Eye, Ear, Nose & Throat Monthly **22**:415 (Nov.) 1943.

53. Frederick, P. M., and Verberkmoes, J. G.: Foreign Bodies in the Air Passages of Children, West. J. Surg. **51**:325 (Aug.) 1943.

54. Baum, H. L.: Foreign Body, Jackstone, in the Esophagus: Perforation, Mediastinitis, Recovery, Arch. Otolaryng. **38**:502 (Nov.) 1943.

might give rise to abnormal appearances and action. Templeton and Kredel [55] devised a roentgenologic technic which has made it possible to study the function of the cricopharyngeus muscle by a totally different method. These newer observations, however, support the endoscopic opinion that the cricopharyngeus muscle possesses the function of localized contraction and is in every sense a true sphincter muscle.

Scant attention has been paid to pain and its relationship to esophageal disorders. This is in great part due to difficulty in describing the pain and also in localizing it accurately. In a study of this subject Moersch and Miller [56] found that esophageal pain may occur in a variety of esophageal disturbances. It may vary in character, intensity and distribution. It is influenced by many extraneous factors and may closely simulate pain produced by other types of serious organic disease. One of the greatest obstacles in the way of a clear understanding of the problem of esophageal pain is a lack of exact knowledge of the innervation of the esophagus.

PEPTIC ULCER OF THE ESOPHAGUS

Bonorino Udaondo, d'Alotto and Nasio [57] believe that peptic ulcer of the esophagus is uncommon and that in many of the cases reported in the literature the "peptic ulcer" was in reality ulcerous esophagitis. The clinical symptoms and endoscopic findings in the two conditions are similar. A peptic ulcer of the esophagus can be demonstrated easily when it is located on the anterior surface of the lower third of the esophagus and can be easily visualized. It appears on the roentgenogram as a loss of tissue or as a niche. It does not narrow the lumen of the esophagus and does not infiltrate its base. It is commonly covered by exudate. The writers report a case of esophageal peptic ulcer which was corroborated by biopsy; the latter showed metaplastic tissue with cells from the gastric fundus. They emphasize the part played by aberrant gastric mucosa in the various segments of the esophagus.

Esophageal peptic ulcer has been found in patients of all ages but is more common in adults. A series of 10 cases is reported by Allison, Johnstone and Royce.[58] Most of the patients were middle aged or elderly. Dysphagia was the outstanding symptom. Pain, hematemesis and vomiting or regurgitation are not uncommon. The diagnosis usually is made by roentgen examination and esophagoscopy.

Treatment is not satisfactory, and the authors are not convinced that any treatment given resulted in the complete cure of patients. Dysphagia has been dramatically relieved by esophagoscopic dilation, but this must be repeated at varying intervals. Areas of ulceration were painted with a 20 per cent solution of silver nitrate, but there is a question whether real improvement resulted. After dilation a strict regimen of rest in bed and adherence to a Sippy diet was enforced for six weeks. The patients were encouraged to sleep in a sitting position in order to minimize the acid regurgitated into the esophagus, and extra fats in the form of cream or olive oil were given. By these means marked symptomatic improvement was achieved, but there always remained some roentgenologic or esophagoscopic sign of persistent ulceration.

Although peptic ulcer of the esophagus has been considered a rare condition, a careful study has revealed its occurrence in several groups of cases. Cleaver [59] noted that it is nearly always observed in cases of congenital short esophagus and cases of diaphragmatic hernia. Because of an incompetent cardia there is regurgitation of the acid contents of the stomach in these cases, and this rather than the secreting of acid juices by islands of ectopic gastric mucosa in the esophagus accounts for the ulceration.

The lesion in these cases is often difficult to differentiate from gastric or duodenal ulcer. The epigastric pain which becomes worse when the patient is recumbent and especially pain which radiates to the shoulders and down either one or both arms are suggestive of esophageal ulceration. The presence of a short esophagus and of hiatal hernia is a definite indication for esophagoscopic investigation to ascertain if ulceration is present. Cleaver reports that in his patients peptic ulcer of the esophagus responded satisfactorily to treatment. He recommends that fluids and semisolids be taken at two or three hour intervals and that solid foods, also hot and cold fluids, be avoided. The use of tincture of belladonna before feedings and the

55. Templeton, F. E., and Kredel, R. A.: The Cricopharyngeal Sphincter: A Roentgenologic Study, Laryngoscope **53**:1 (Jan.) 1943.

56. Moersch, H. J., and Miller, J. R.: Esophageal Pain, Gastroenterology **1**:821 (Sept.) 1943.

57. Bonorino Udaondo, C.; d'Alotto, V., and Nasio, J.: Peptic Ulcer of the Esophagus, Prensa méd. argent. **30**:1342 (July 21) 1943.

58. Allison, P. R.; Johnstone, A. S., and Royce, G. B.: Short Esophagus with Simple Peptic Ulceration, J. Thoracic Surg. **12**:432 (June) 1943.

59. Cleaver, E. E.: Chronic Peptic Ulcer of the Esophagus, Am. J. Digest. Dis. **10**:319 (Sept.) 1943.

employment of an alkaline mixture were found helpful. He also reported that duodenal tube feeding was satisfactory.

HIATAL HERNIA

Herniation of a portion of the stomach through the esophageal hiatus is not uncommon. While dysphgaia is frequent and sometimes is the only symptom, Vinson [60] points out the necessity of distinguishing this from other esophageal lesions as well as from coronary heart disease and intra-abdominal lesions, especially chronic cholecystitis.

Two important diagnostic aids are roentgen examination and esophagoscopy. In the roentgen study, unless the patient is examined in the recumbent or the Trendelenburg position the hernia may be overlooked. In all questionable cases esophagoscopic examination is indicated. If the hernia is associated with symptoms, surgical repair should be recommended if the condition of the patient is satisfactory and the symptoms are sufficiently severe to warrant such a procedure. Even if symptoms are mild, surgical treatment is indicated if the patient is a good operative risk, because there is a likelihood of increase in the size of the hernia and progression of symptoms, also a greater risk of death from the condition as the patient grows older. In no case, however, should surgical treatment be contemplated until the esophagus has been investigated completely and found to be free from any obstructive lesion.

In cases not suited for surgical treatment passage of a sound over a previously swallowed thread will give relief if dysphagia is troublesome. Repeated passage of sounds may be necessary if there has been marked cicatricial stenosis. Avoidance of heavy evening meals and sleeping in a semierect posture may also diminish nocturnal discomfort.

NEOPLASM OF THE ESOPHAGUS

Carcinoma of the esophagus which constitutes the most frequent tumors of the esophagus should be classified as its most common disease. Woodward [61] emphasizes that the diagnosis of carcinoma can readily be made by roentgen examination and esophagoscopy, and if the diagnosis is made early, the carcinoma can be removed surgically with reasonable hope that many will be cured. Unfortunately, the disease commonly is advanced before the diagnosis is made. He emphasizes the importance of physicians and laity recognizing the potential seriousness of persistent dysphagia.

Displacement of the esophagus is not unusual with mediastinal neoplasms which do not have their origin in the esophagus. Because of the relative infrequency of symptoms referable to the esophagus in these cases, Hill and Vinson [62] studied a series of 50 cases of mediastinal tumor with reference to pressure on the trachea, the bronchi and the esophagus. In 32 cases pressure on the air passages was demonstrated, with evidence of dyspnea in 31. In 11 instances there was evidence of pressure on the esophagus but dysphagia was observed in only 4 of these. In 3 of the latter cases the dysphagia was mild and not a major complaint. In the fourth case it was the outstanding symptom. It is believed that the mobility and elasticity of the esophagus account for the infrequent occurrence of symptoms in this group of cases whereas the trachea and bronchi, being more rigid, are more commonly compressed by external pressure with resulting dyspnea.

SCLERODERMA OF THE ESOPHAGUS

Although difficulty in swallowing has been reported in 16 cases of diffuse scleroderma, Lindsay, Templeton and Rothman [63] found that medical literature contained but one report of an esophagoscopic examination made during life. In this case there was marked stenosis near the lower end of the esophagus, which suggested scar tissue.

The authors studied 5 cases of diffuse scleroderma, and esophagoscopic examination was done in 4. They believe that esophageal disturbances are a characteristic manifestation of diffuse scleroderma and that they are likely to appear early in the course of the disease. The symptoms usually are slight in the earlier stages, and little attention is paid to them until there develops definite obstruction to swallowing. They believe that the esophageal disturbances are characterized by loss of peristalsis in the lower two thirds with relaxation and mild dilatation down to the phrenic ampulla and probably some atony of the cardiac sphincter. This occurs as a direct result of the sclerodermatic process. There is difficulty in swallowing solids or liquids, especially when the patient is in the prone

60. Vinson, P. P.: Treatment of Dysphagia from Hernia Through Esophageal Hiatus in Diaphragm, Arch. Otolaryng. **38**:27 (July) 1943.

61. Woodward, F. D.: Carcinoma of the Esophagus, South. M. J. **36**:590 (Aug.) 1943.

62. Hill, H. N., and Vinson, P. P.: Incidence of Dysphagia from Intrathoracic Extraesophageal Tumors, Pennsylvania M. J. **46**:814 (May) 1943.

63. Lindsay, J. R.; Templeton, F. E., and Rothman, S.: Lesions of the Esophagus in Generalized Progressive Scleroderma, J. A. M. A. **123**:745 (Nov. 20) 1943.

position, due to delayed emptying of the esophagus. The burning pain behind the sternum occurring about an hour after meals, worse when the patient is lying down and particularly when he is lying on the left side, is due probably to regurgitation of gastric contents into the esophagus with the resulting chronic esophagitis.

Chronic ulceration occurs in the lower third of the esophagus and is localized chiefly to the region just above the phrenic ampulla. This is probably a direct result of the esophagitis with sclerodermatic changes as a predisposing factor. Formation of stricture is observed in the later stages and is limited to the region immediately above the phrenic ampulla of the esophagus. In the cases examined by them biopsy revealed changes in the connective tissue of the submucosa which suggested sclerodermatous changes.

Two patients with esophagobronchial fistula between the right main bronchus and the esophagus, which had existed for nine and thirty-two months, respectively, were treated by Clerf, Cooley and O'Keefe.[64] No definite cause for the development of the fistula in either could be demonstrated, although in the first patient pulmonary abscess developed and a mass of necrotic tissue was coughed up immediately preceding the development of symptoms.

In both cases the esophagus was placed at rest, but there was no apparent tendency for the fistula to close under this regimen. In the first case attempts were made to obliterate the fistula with the aid of topical applications of a 25 per cent solution of acriflavine hydrochloride and later of 25 and 50 per cent solutions of silver nitrate, with no success. Prompt closure of the esophageal end of the fistula resulted after esophagoscopic application of sodium hydroxide crystals fused on a curved metal applicator and carried into the fistula for a distance of several centimeters. The patients have been eating normally and have been free from symptoms for over eighteen months.

LOCAL ANESTHESIA FOR GASTROSCOPY

Tetracaine hydrochloride is quite generally used as a local anesthetic either in the form of a gargle or by instillation into the tracheobronchial tree and is considered a safe anesthetic. A warning of possible danger from this, however, is contained in the report by Hansen and Stealy,[65] who employed it as a gargle to secure relaxation of the pharyngeal muscles preceding a gastroscopic examination. The patient, an adult aged 54 years, had received a sedative (pentobarbital sodium) one hour before the scheduled examination and ¼ grain (0.016 Gm.) of morphine sulfate fifteen minutes before the examination. Immediately preceding the gastroscopy he was given 1 drachm (3.88 Gm.) of a 2 per cent solution of tetracaine hydrochloride in physiologic solution of sodium chloride to gargle. None of the solution was swallowed. During the procedure the patient suddenly collapsed, respirations ceased and cyanosis developed. The pulse rate remained regular. Within two minutes there were generalized convulsive seizures which lasted from fifteen to thirty seconds. Artificial respiration and supportive measures were instituted, but in spite of these the heart stopped beating one hour and thirteen minutes after the patient first collapsed. A complete postmortem examination was made, but this revealed no organic reason for the sudden death. Because of the manner in which death occurred and the absence of any demonstrable cause, it was believed to be due to an anaphylactic reaction to the tetracaine in the gargle.

GASTROSCOPY FOR DIAGNOSIS

The use of fluorescein to stain and assist in outlining gastric ulcers of the mucosa which might otherwise be overlooked or be inadequately visualized by gastroscopic examination was suggested by Robinson.[66] Ten cubic centimeters of a 1 per cent solution of fluorescein was introduced into the stomach through an Ewald tube after the gastric contents had been drained. Gastroscopy was then performed in the usual manner. He noted that fluorescein was helpful in visualizing superficial ulcers of the gastric mucosa, aided in outlining them and permitted more accurate estimation of the diameter of the ulcer.

There has been considerable discussion among gastroscopists regarding the origin and the significance of hemorrhagic or pigmented spots in the gastric mucosa. In a study of this subject Ruffin and Brown [67] were able to produce these by the application of suction to the gastic mucosa in experimental animals. They express the opinion that the factor of trauma should be carefully considered in the interpretation of gastric findings and that these spots which can be produced by irritation of the stomach may occur in

64. Clerf, L. H.; Cooley, E. E., and O'Keefe, J. J.: Esophagobronchial Fistula, Surg., Gynec. & Obst. **77**: 615 (Dec.) 1943.

65. Hansen, F. M., Jr., and Stealy, C. L.: Sudden Death Following the Use of Pontocaine as a Gargle Anesthetic for Gastroscopic Examination, Rev. Gastroenterol. **10**:212 (July-Aug.) 1943.

66. Robinson, H. M.: Fluorescein: An Aid in Gastroscopy, Am. J. Digest. Dis. **10**:181 (May) 1943.

67. Ruffin, J. M., and Brown, I. W., Jr.: The Significance of Hemorrhagic or Pigment Spots as Observed by Gastroscopy, Am. J. Digest. Dis. **10**:60 (Feb.) 1943.

healthy persons and probably have no clinical significance.

Complications resulting from the use of the flexible gastroscope are rare, and although a number of cases of perforation of the stomach and 1 case of perforation of the duodenum have been reported, there has been but 1 case in which death was unquestionably attributed to its use. Paul and Lage [68] report a case of death following examination by the flexible gastroscope. The procedure was carried out without difficulty and no complications were anticipated, but four hours after gastroscopy the patient complained of pain in his throat with difficulty in swallowing. Six hours later he had a chill, and his temperature rose to 102 F. Later there were cyanosis and dyspnea with crepitus over the right side of the neck and the upper portion of the chest anteriorly. At autopsy the anterior and the posterior mediastinum and the entire pericardium were observed to be the seat of fulminating cellulitis. The esophagus appeared normal and no perforation could be discovered, but it was believed that there was a small tear in the esophagus which was closed by serum or exudate and was responsible for the fatality.

HYPERTROPHIC GASTRITIS

There is much confusion in the minds of most physicians concerning hypertrophic gastritis. With the employment of the flexible tube gastroscope the diagnosis now is a common one, yet gastroscopists do not all agree on the criteria for the diagnosis. In a series of 1,300 cases in which gastroscopy was performed, Benedict [69] made a diagnosis of hypertrophic gastritis without other gastric or duodenal alteration in 117 cases, an incidence of 9 per cent. The expert roentgenologist using the relief technic may aid in the diagnosis of gastritis but the only positive diagnosis is made by gastroscopy and only by gastroscopy can a differential diagnosis be made between the superficial, the atrophic and the hypertrophic forms of gastritis.

GASTROSCOPY FOR DIAGNOSIS

In an analysis of 1,000 consecutive cases in which men in the military service were subjected to gastroscopic examination Gill [70] attempts to determine the value of the indications for gastroscopy and the assessment of dyspepsia. He expresses the opinion that in cases of gastric ulcer the gastroscope may reveal ulcers not otherwise demonstrable and that it affords proof of healing more cheaply and accurately than any other method. In cases of chronic gastritis it provides confirmation not otherwise obtainable and enables differentiation of types and degrees of severity essential for satisfactory disposal of persons in the military service and also for treatment. Multiple gastric erosions are not demonstrable by roentgen study, but by gastroscopy lesions of some significance can be diagnosed and differentiated into the chronic and the acute, and disposal can be made accordingly. While these are the more numerous conditions, others, including gastric carcinoma, benign gastric tumor, postoperative dyspepsia, unexplained gastric hemorrhage and achlorhydria, can also be diagnosed.

While the occurrence of syphilis of the stomach has been well established, the case reported by Palmer and others [71] is of interest because the classic pathologic criteria are so well fulfilled and the diagnostic difficulties are well illustrated.

Accurate data correlating what is seen by the gastroscopist in the living stomach with what is seen by the pathologist in the dead stomach are hard to obtain and often difficult to evaluate. Benedict and Mallory [72] have published comparative gastroscopic and histologic observations made in a series of 51 selected cases. All were made on surgically resected specimens.

In the 51 cases all types of gastritis were included. There was complete gastroscopic-pathologic agreement in 28 cases (59.9 per cent) and partial agreement in 17 cases (33.3 per cent) or a total complete or partial agreement of 88.2 per cent. There appeared to be no correlation in the 6 remaining cases (11.8 per cent). Analysis of the separate types of gastritis showed agreement in 74.5 per cent of the hypertrophic, 66.7 per cent of the superficial and 66.7 per cent of the atrophic forms.

1530 Locust Street.

68. Paul, W. D., and Lage, R. H.: Perforation of Esophagus Caused by Flexible Gastroscope, J. A. M. A. **122**:596 (June 26) 1943.

69. Benedict, E. B.: Hypertrophic Gastritis: Gastroscopic and Clinical Studies, Gastroenterology **1**:62 (Jan.) 1943.

70. Gill, A. M.: Evaluation of Gastroscopy: Analysis of 1,000 Examinations, Lancet **1**:333 (March 13) 1943.

71. Palmer, W. L.; Schindler, R.; Templeton, F. E., and Humphreys, E. M.: Syphilis of the Stomach: A Case Report, Ann. Int. Med. **18**:393 (March) 1943.

72. Benedict, E. B., and Mallory, T. B.: Correlation of Gastroscopic and Pathological Findings in Gastritis, Surg., Gynec. & Obst. **76**:129 (Feb.) 1943.

Abstracts from Current Literature

Ear

FACIAL PARALYSIS ASSOCIATED WITH OTITIS MEDIA. RUSSELL M. DECKER, Laryngoscope **54**:186 (April) 1944.

Decker touches on the anatomy of the facial nerve and on the general causes of facial paralysis. The location of the injury can often be determined from the type of paralysis. In 15 per cent of 400 cases of facial paralysis at the Los Angeles General Hospital the paralysis was associated with otitis media and its complications. Conclusions are drawn as to how to proceed in such cases.

HITSCHLER, Philadelphia.

THE TREATMENT OF MÉNIÈRE'S DISEASE. T. E. CAWTHORNE, J. Laryng. & Otol. **58**:363 (Sept.) 1943.

Some of the more generally accepted measures for the treatment of Ménière's disease are reviewed. Sedatives have long been used, and phenobarbital has proved the most satisfactory. Overloading of the labyrinth with fluids has been combated by the use of pilocarpine and diuretics and by reduction of the intake of fluids. Furstenberg described a regimen that favored excretion of the fluid-binding sodium. Histamine has proved of value in some cases. Nicotinic acid has been advocated for its vasodilative action. Inflation of the eustachian tube is done extensively, with questionable results. Portmann advocated drainage of the endolymphatic sac. Section of the vestibular portion of the eighth nerve has been advocated by Dandy, Aubry, Ombredaune, Cairns and Brain, who all report excellent results. Wright injects alcohol into the perilymph space through the tympanic membrane and the stapedial foot plate.

The author advocates two forms of treatment as being helpful. He states that a combination of scopolamine, 1/600 grain (0.11 mg.), and hyoscyamine, 1/150 grain (0.43 mg.), in tablet form taken one to three times daily is frequently sufficient to control attacks of vertigo. Excessive dryness of the throat or transitory blurring of vision may call for smaller doses.

If this or a combination of other conservative measures does not keep the symptoms in check, the possibility that the labyrinthine function should be destroyed is considered. This destruction is accomplished by approaching the labyrinth via the mastoid process, sufficient bone being removed to insure a good view of the external semicircular canal. A diamond burr is used to open the endolymphatic space, and to insure good opening a portion of the membranous labyrinth is removed from the external canal. The operative procedure is described, and the results obtained are given in tabulated form. It would seem that the relief obtained by the patient justifies the surgical intervention.

LE JEUNE, New Orleans.

Pharynx

SELF-INFLICTED DIVISION OF LARYNX AND THYROID AND DIVISION OF TRACHEA AND ESOPHAGUS, WITH RECOVERY. WILLARD W. SCHUESSLER, J. A. M. A. **125**:551 (June 24) 1944.

A patient was admitted to an army hospital on March 4, 1942 with a history of a self-inflicted wound to remove his "voice box." He had a transverse incision at the level of the hyoid bone from one sternomastoid muscle to the other, and he was cyanotic from hemorrhage and clots in his neck. In a paper bag brought in by the ambulance attendant was a specimen showing the hyoid bone, the larynx and a portion of the trachea and esophagus. An incision was immediately made in the midline down to the junction of the trachea, which had been cut off. After the clots over the tracheal opening had been cleaned out the patient's cyanosis was relieved.

It was found that he had removed his hyoid bone, the larynx, the thyroid gland (including three parathyroid glands), the trachea down to about the third ring, about 2 inches (5 cm.) of the anterior part of the esophagus, and about ½ inch (1.27 cm.) of the posterior part of the esophagus.

The edges of the skin made by the vertical incision were sutured to the remaining portions of the esophagus and the trachea, and the posterior portions of the esophagus were sutured together. Three days later a gastrostomy was done, and a silk thread was run through the patient's nose, down the esophagus and out the gastrostomy opening. This was done to facilitate dilation if it should become necessary afterward.

A few days later a written statement was obtained from the patient stating that he cut his throat with a single edge razor blade, placed his fingers in the trachea and pulled the specimen aforementioned out of the incisions and cut it off.

Three weeks later the plastic repair of the esophagus was started. The contracture due to the suturing of the posterior wall of the esophagus was relieved by a Z plastic. A flap 3 inches long by 2½ inches wide (7.5 by 6 cm.) was outlined on the left side of the neck, elevated and sutured back into its original position. Then a flap on the right side 3 inches long by 4½ inches wide (7.5 by 11 cm.) was elevated, leaving a border of normal skin ½ inch wide and 3 inches long next to the esophagus.

In three weeks the flaps were elevated again, and the flap on the left side was turned on itself and sutured to the normal skin left adjoining the esophagus; the ends were sutured to the remaining portion of the esophagus. The flap on the right side was brought across the anterior wall of the esophagus formed by the flap from the left side and into the defect left by the flap from the left side.

The sutures were removed in seven days, and the wounds had completely healed. The patient was then given a liquid diet, and the gastrostomy wound was closed one week later. He was given a general diet and ate regular army rations until he was discharged from the hospital.

The possibility of growth of hair in the esophagus was discussed with the dermatologist and radiologist, and it was felt that epilation by roentgen irradiation would reduce the vitality of the flaps; hence this treatment was felt not to be indicated. After six months esophagostomy was done, and no growth of hair was found. When the patient was discharged, he was eating regularly and had gained 35 pounds (16 Kg.).

GORDON, Philadelphia.

Larynx

BRONCHOSCOPY IN THE NEWBORN INFANT. FLETCHER D. WOODWARD and WILLIAM W. WADDELL JR., J. Pediat. **23**:79 (July) 1943.

When indicated bronchoscopy is a life-saving procedure. Woodward and Waddell present reports to illustrate the safety and the value of this procedure with the newborn infant. At present the indications for the use of the bronchoscope in the newborn infant are not clearcut, and it is employed only when the usual procedures have failed. The authors advise that it be used more frequently in the treatment of all types of congenital atelectasis.

In 1 case described, a 5½ pound (2,495 Gm.) twin was hospitalized six hours after birth because of persistent cyanosis and dyspnea, which cleared with administration of oxygen but returned when the baby was taken out of the incubator. A roentgenogram of the chest revealed collapse of the left lung, with the heart and mediastinum drawn to the left. Since no improvement occurred in three days, a 3.5 mm. bronchoscope was introduced and suction was applied to the left bronchus. The procedure lasted three minutes. Prompt improvement followed, and a roentgenogram taken two days later showed normal aeration.

The second case reported was that of a newborn premature infant (1,860 Gm.) with massive congenital atelectasis of the left lung due to absence of the left main bronchus. The baby was examined bronchoscopically at 9 days of age with a 3.5 mm. bronchoscope and again at 18 days of age. When the infant was 26 days old, 2 cc. of iodized poppyseed oil was injected into the trachea through a laryngoscope; roentgenograms were taken, and the oil was removed by suction. The procedure was well tolerated. The child is now 16 months old, and the left lung is still unaerated.

A case of massive congenital atelectasis of the left lung due to congenital absence of the left main bronchus in an 11 year old boy is presented because of its rarity and interest.

The cases of 2 newborn infants with partial congenital atelectasis and pneumothorax who died several hours after bronchoscopic treatment are described. Autopsies were not permitted. In these 2 infants the procedure was well tolerated, and death was not deemed to be due to it.

SHMIGELSKY, Chicago. [AM. J. DIS. CHILD.]

Nose

DIAGNOSIS AND TREATMENT OF SINUSITIS IN CHILDREN. D. E. STAUNTON WISHART, Laryngoscope **54**:97 (March) 1944.

Sinusitis is frequent in children, occurring perhaps in 30 per cent.

Much more should be known of the anatomy and the physiology of the nose. The author shows that the bony structure and the mucosa of the inferior turbinate are of a little known and very special design. He describes it from the point of view of anatomy. He also describes the ostiums of the sinuses. They can be compared to manholes almost completely filled with hoses (nerves, arteries, veins). Injury to a sinal ostium may seriously damage the sinus. The middle turbinate region is the most important from the point of view of the etiology of sinusitis, for most of the sinuses open into this area.

In the diagnosis of sinusitis a careful history is important. The symptoms include stuffy nose, nasal discharge, nasopharyngitis, protracted fever, cough, postnasal drip (only older children notice it), headache (rare up to the age of 6), pain and impairment of the sense of smell (indicative of ethmoiditis).

The histopathologic changes in disease of the sinuses are described. The importance of preventing the onset of chronic sinusitis is stressed.

Careful shrinking, transillumination and nasopharyngoscopic and roentgen examinations should be carried out in order to establish a diagnosis. Radiopaque substances are often of value.

Sinusitis must be differentiated from allergic rhinitis. Many of the symptoms and signs are not reliable for differential diagnosis. Two things are reliable, however: (1) the inability to shrink the nasal mucosa of the allergic patient with cocaine, epinephrine or ephedrine and (2) the appearance of an excessive number of eosinophils in the nasal secretions and sputum in allergy.

Treatment is discussed. Splashing the face with cold water and using the steam kettle often improve the physiologic function. Crying and sneezing are aids in getting rid of nasal secretion. The use of faintly acid nose drops is recommended. Stagnant thick mucin promotes bacterial growth and should be removed. Irrigations with warm saline solutions help remove it. They must be given properly (the face downward). The lateral head low position is also good. With it the middle meatus can be shrunken and cleared. Washing of the maxillary sinus by a needle puncture under the middle turbinate is recommended, while washing via a natural ostium is condemned.

The author does not treat children's sinuses by displacement. The child is afraid, and its confidence is lost. Furthermore, uninfected sinuses may become infected. Tampons or packs are condemned. Short wave and roentgen treatment have not proved beneficial. The results of treatment with sulfonamide compounds are encouraging but not conclusive. The protracted use of sulfonamide compounds is not advised.

The author disapproves in general of surgical operation on the sinuses in children. Excellent results were achieved by conservative therapy at the Hospital for Sick Children, in Toronto, Canada. In each case the disease must be first properly diagnosed and treated conservatively. The surgeon must then perform only measures that are needed and no more. He must handle the postoperative care himself. The purpose of surgical intervention is to restore the nose and sinuses to a good physiologic condition.

The removal of the anterior third of the middle turbinate is often of great value, particularly if it blocks the middle meatus. Better drainage results.

The inferior turbinate has great functional value and should not be disturbed. Removal, cauterization and coagulation of this structure should not be performed.

Major surgical procedures have their place but should be avoided if possible.

HITSCHLER, Philadelphia.

SPREADING OSTEOMYELITIS OF THE FRONTAL BONE TREATED WITH PENICILLIN. H. L. WILLIAMS and D. R. NICHOLS, Proc. Staff Meet., Mayo Clin. **18**: 467 (Dec. 1) 1943.

Williams and Nichols report on the successful treatment of 2 patients with spreading osteomyelitis of the frontal bone. Both patients had received apparently adequate doses of sulfadiazine or sulfathiazole without control of the infection. There was a prompt favorable

response to penicillin. One of the patients had a subperiosteal abscess associated with an epidural abscess, which subsequently was treated surgically.

GUTTMAN, New York.
[ARCH. NEUROL. & PSYCHIAT.]

A CASE SHOWING PARTIAL DEFICIENT FUSION OF A MAXILLARY PROCESS WITH LATERAL NASAL PROCESS ON ONE SIDE. G. E. DODDS, Brit. J. Ophth. **27**:414 (Sept.) 1943.

A Negro girl aged 3 months presented the congenital abnormalities to be described. The outstanding defect was distortion of the right nostril with a hiatus showing the interior of the nose, the cleft extending upward to within 1 cm. of the inner canthus, which had a wide, obtuse angle. There were small notches, or colobomas, in both upper lids and a notch in the right lower lid. There was no caruncle, and the presence of a plica semilunaris was doubtful. On the inner side of the medial canthus of the left eye there was a vertical hole, in appearance like the opening of a sinus. The cleft, or fissure, extended from the lower and lateral margin of the right nasal bone to a point where normally the nostril joins the lip. This was merely a cleft in the cartilaginous part of the nose. The eyes were normal in every respect.

A sketch accompanies the article.

ZENTMAYER, Philadelphia. [ARCH. OPHTH.]

Miscellaneous

LIPID PNEUMONIA. ARTHUR M. STOKES, Am. Rev. Tuberc. **47**:348 (March) 1943.

A man 62 years old had symptoms and physical signs which indicated the presence of a cancer or an abscess of the lung. During an exploratory thoracotomy the surgeons so strongly suspected the presence of a cancer that they removed the lower and middle lobes of the right lung. Microscopic examination revealed lipid pneumonia and an abscessed condition. Further inquiry into the patient's history elicited the facts that for several years he had used petrolatum freely in his nose on retiring, that for more than a year he had used a proprietary preparation containing oil and that he habitually slept on his right side.

EUGENE SMITH, Ogden, Utah.
[AM. J. DIS. CHILD.]

A PHONOGRAPHIC SCALE FOR THE MEASUREMENT OF DEFECTIVE ARTICULATION. ROBERT CURRY, LOU KENNEDY, LORETTA WAGNER and WALTER WILKE, J. Speech Disorders **8**:123 (June) 1943.

A selection containing all the sounds used in English and most of the consonant blends was read by 8 children whose speech varied from completely unintelligible to normal, and recordings were studied by 10 adults. Deficiencies in the experiment were corrected in a second series, of 10 recorded samples judged by 131 to 192 observers. These recordings were ranked to form a scale which can be used to measure the intelligibility of a person's speech and the seriousness of any articulatory defect by comparison with the phonographic samples.

PALMER, Wichita, Kan.
[AM. J. DIS. CHILD.]

A NOTE ON VOICE RECORDINGS. ERNEST H. HENRIKSON, J. Speech Disorders **8**:133 (June) 1943.

In nearly half of the cases in this study there was no change in judgment of his own speech by the person tested after he heard a recording of it. Some subjects moved closer to the observers' ratings, and some moved farther from these evaluations. The four trained judges did not agree in more than 20 per cent of the cases for pitch, 56 per cent for rate and 48 per cent for loudness. It is apparent that even experienced persons make errors in the evaluation of these three factors in speech.

PALMER, Wichita, Kan.
[AM. J. DIS. CHILD.]

A CARDIOVASCULAR AND METABOLIC STUDY OF STUTTERERS AND NON-STUTTERERS. C. H. RITZMAN, J. Speech Disorders **8**:161 (June) 1943.

In a study of 29 stutterers at the University of Iowa Ritzman was unable to replicate most of Palmer's and Gillette's results. No significant differences were found for heart rate, but the study tended to confirm the previous observation that women who stutter have less marked sinus arrhythmia than those who do not. The author believes that such studies are of more value if the divergences from normal are interpreted as the physiologic consequences of stuttering rather than as etiologic factors.

PALMER, Wichita, Kan.
[AM. J. DIS. CHILD.]

Society Transactions

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLARYNGOLOGY, AND PHILADELPHIA LARYNGOLOGICAL SOCIETY

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Regular Meeting, April 19, 1944

SYMPOSIUM ON CHEMOTHERAPY AND BIOTHERAPY IN OTOLARYNGOLOGY

Chemotherapy. Presented by DR. DANIEL S. CUNNING (by invitation).

During the past ten years great strides have been made in the treatment of suppurative disease of the ear, nose and throat by means of chemotherapy. Although we have heard a great deal about the sulfonamide drugs and penicillin of late, chemotherapy itself is not new. The first chemotherapeutic agent dates back to the fourteenth century, when mercury was brought out for the treatment of syphilis. In the fifteenth century quinine was given to the medical profession for the treatment of malaria. Nothing further was done along this line of therapy for almost five hundred years. Then, in 1910, Ehrlich introduced arsphenamine for the treatment of syphilis. In this same year Gelmo discovered sulfanilamide but did not apply it clinically. It remained for Domagk, in 1932, to notice the potency of sulfanilamide in combating hemolytic streptococcus infections in mice.

Sulfonamide Drugs.—Sulfanilamide was first put on the market and used by physicians in 1935, and within a year or two its use was the standard and accepted treatment for practically all diseases of infectious origin. It worked especially well against streptococcic infections and to a lesser degree against other organisms. In 1937 another of these drugs came into use, sulfapyridine. It was found that this drug worked well against pneumococcic infections, on which sulfanilamide had little effect. One bad feature of this drug, however, is that it is much harsher in action on the kidneys and produces many serious renal complications. In 1938 sulfathiazole was introduced; it served well against staphylococci and was not as toxic as sulfapyridine. In 1939 another great drug was given to the profession, namely, sulfadiazine. This drug acts well against streptococci, pneumococci, staphylococci and gonococci, just as well if not better than the other drugs, and is much less toxic. To the present time over a hundred different sulfonamide drugs have been put on the market, but sulfadiazine still is the drug of choice.

After the administration of any of the sulfonamide compounds there may be destruction of the white blood cells. My colleagues and I have observed leukopenia following sulfadiazine in several cases, and it has been observed following the other sulfonamide drugs. Occasionally agranulocytosis or granulocytopenia occurs. This is one of the most serious reactions with which physicians have to contend after the use of sulfonamide drugs. Fortunately it does not occur frequently. Furthermore, it occurs only after a large amount of the drug has been given or when treatment with the sulfonamide compounds is repeated. If it occurs with one sulfonamide compound, changing to another is dangerous. Hyperleukocytosis, which is almost always associated with acute hemolytic anemia, occurs as an unusual and infrequent reaction. We have observed no such reactions following sulfadiazine.

It must be remembered that sulfonamide drugs are never to be used in place of a surgical operation but rather as an aid to surgical treatment. They should never be used in a mild, self limited disease or in a disease in which the danger of toxicity is greater than that of the disease itself. As to local uses, dusting a powdered sulfonamide compound into wounds, such as those from mastoidectomy, laryngectomy and operations on sinuses, helps a great deal. In the radical mastoidectomy in which skin grafting is to be done, sulfonamide drugs should not be used, as the graft oftentimes will not take. Sulfanilamide powder seems to act best, since it does not cake. In chronically discharging ears, it seems to serve well, as it does in the cavity from radical mastoidectomy to which skin has not been grafted. One thing to remember in using it as a dusting powder is not to use too much. Dust it on lightly.

The dosage of a sulfonamide compound depends on many things, such as whether the drug is given prophylactically or for active treatment, whether the disease is serious or mild, whether the patient is an adult or a child and whether he is large or small. The prophylactic dosage for the adult as a rule is 15 grains (1 Gm.) every four hours. But in the presence of active and serious infections the dose is much larger in order to get the proper amount into the blood stream as soon as possible. Sixty to eighty grains (4 to 5 Gm.) is given for the first dose; then 30 grains (2 Gm.) is given every four hours for two or three doses, and finally 15 grains (1 Gm.) every four hours day and night. This is important, to give the drug every four hours day and night. Once the blood level stays at 10 to 20 mg. per hundred cubic centimeters, it can be maintained easily with small doses. To very sick patients, in whom we want to get the drug into the blood stream as soon as possible, we give 10 cc. of 25 per cent sodium sulfadiazine in 40 cc. of sterile distilled water intravenously, which shows in the blood within fifteen to twenty minutes. This is repeated in four hours if we have not the desired concentration, and then the patient is given 15 grains (1 Gm.) every four hours by mouth. It is important to keep the patient on small doses of the drug for a week or ten days after the symptoms have disappeared. The dose for children is cut down according to the weight of the child. The average initial dose in severe infections is about 0.1 Gm. per kilogram of body weight or 0.7 grain

per pound, and the subsequent dose is one sixth or one fourth of the initial dose every four hours, day and night.

Is it necessary to work for a certain blood level? Some patients seem to do well with a low level, but most do better with a high one. We believe that it should be over 5 mg. per hundred cubic centimeters with most of these drugs but with sulfadiazine from 10 to 20 mg. In serious cases we always feel safer to have it much higher. In 2 cases of type III pneumococcic meningitis we ran it up to 40 to 45 mg. per hundred cubic centimeters, and both patients recovered.

Penicillin.—Penicillin, the newest of the chemotherapeutic drugs, is effective in cases in which the sulfonamide drugs fail to control the infection. It was discovered by Alexander Fleming at the University of London in 1929 but was not used clinically until about three years ago. It remained for the Oxford investigators (Chain Florey and others) to prepare in 1940 a highly concentrated and active preparation of penicillin suitable for clinical use. It is obtained from molds and produced in very small quantities; 1 cc. of the fluid produces only 2 units of penicillin. It is relatively nontoxic and at the same time bacteriostatic under certain conditions. It is not related to, nor does it behave like, any of the other chemotherapeutic substances now in use. It is not hemolytic. It is highly soluble. It does not behave as a detergent. Its action is not inhibited by the presence of para-aminobenzoic acid nor by the products of the destruction of tissue.

Penicillin is far superior to any of the sulfonamide compounds in the treatment of Staphylococcus aureus infections with or without bacteremia, including acute and chronic osteomyelitis, cellulitis, carbuncles of the lip and face, pneumonia, empyema, infected wounds and burns. It is also extremely effective in the treatment of infections with hemolytic streptococci, pneumococci and gonococci, which are resistant to the sulfonamide compounds. It has not been found effective in the treatment of subacute bacterial endocarditis.

Penicillin does not enter the meningeal spaces or the spinal fluid after intravenous or intramuscular injection. Therefore, in addition to being injected intramuscularly or intravenously, it must be given directly into the spinal fluid in the treatment of meningitis. In empyema the drug must be injected into the cavity itself; giving it intravenously or intramuscularly alone is not sufficient.

The drug may be given intravenously every four hours continuously, intramuscularly and topically; the latter mode includes local injections into the pleura, the pericardium, the joints and the subarachnoid space. It may be given all ways at the same time. Some tolerate intramuscular better than intravenous injections and vice versa. In the treatment of meningitis, empyema and surface burns of limited extent, penicillin is also used topically; i. e., it is injected directly into the subarachnoid space or the pleural cavity or applied locally.

The dose is graded in Oxford units. The amount of the drug given varies tremendously from one case to another. Likewise, there are great variations in the total amount given with each injection, the interval of time between injections and the total duration of the treatment. In the beginning it was common practice to give 5,000 units intravenously every four hours day and night, i. e., 30,000 Oxford units every twenty-four hours. This amount was found to be adequate in some infections but was totally inadequate in others. The dose often varied from 1,000 to 25,000 units per hour depending on the kind or the severity of the infection.

The adequate or the optimum dosage has not been clearly defined to date. The objective in treatment should be the maintenance of a sufficient concentration of penicillin in the blood to inhibit completely the growth of the individual infecting organism.

For serious infections due to hemolytic streptococci, Staph. aureus or pneumococci with or without bacteremia an initial dose of 15,000 to 20,000 Oxford units should be given, with continuing dosage as follows: 5,000 units every hour injected into the tubing of an inlying intravenous set. There should be constant intravenous injection of a solution at a rate designed to deliver 5,000 to 10,000 units per hour. Occasionally it is necessary to give larger doses. After the temperature has returned to normal, the total dose in the twenty-four hour period may be reduced one half, but it should be administered for at least seven days after the temperature is normal.

For chronic infections, such as those of compound fractures or septic infections of soft parts, the initial dose should be 10,000 units. This is followed by 15,000 units every three hours, with local treatment as indicated.

For gonorrhea resistant to sulfonamide compounds the dosage is 10,000 units every three hours for twelve doses.

In cases of empyema penicillin in isotonic solution of sodium chloride should be injected into the cavity after aspiration of the pus or fluid. This should be done once or twice daily, with 30,000 or 40,000 units.

For meningitis 10,000 units of penicillin in isotonic solution of sodium chloride is injected into the subarachnoid space or intracisternally once or twice daily; the solution is also given intravenously or intramuscularly at the same time.

For pneumonia 60,000 to 90,000 units a day is administered for three to seven days.

From the study of 500 cases of infection treated with penicillin by twenty different investigators throughout this country, the following conclusions are justified: Penicillin is a remarkably potent antibacterial agent which can be given intravenously, intramuscularly or topically. It is ineffective when given by mouth. Following intravenous or intramuscular injection, it is excreted rapidly in the urine, so that if an adequate amount of it is to be maintained in the circulating blood and tissues it has to be injected continuously or at frequent intervals, i. e., every three to four hours.

Penicillin has been found to be most effective in the treatment of staphylococcic, gonococcic, pneumococcic and hemolytic streptococcus infections. It has been disappointing in the treatment of bacterial endocarditis. Its effect is particularly striking in gonococcic infections that are resistant to sulfonamide compounds.

In the treatment of empyema or meningitis it is advisable to use penicillin topically by injecting it directly into the pleural cavity or the subarachnoid space, in addition to intramuscular or intravenous administration.

Chemotherapy and Biotherapy. Presented by DR. JOHN L. KOLMER (by invitation).

This article was published in full in the July issue of the ARCHIVES OF OTOLARYNGOLOGY, page 17.

DISCUSSION

DR. WILLIAM L. WHITE (by invitation): I should like to ask Dr. Kolmer a question. First, I do not quite understand the preparation of his cold vaccine. I under-

stand that he took the organism that he cultured from the patient. The attention of physicians has been focused on the resistance of certain organisms to others. I wonder if the antibacterial secretions of one organism might impair the vaccine finally prepared. The use of exotoxin in the vaccine might stimulate the body in its resistance against this exotoxin, but would it stimulate the body to resist the development or growth of certain organisms in the body?

I should also like to make a few remarks about penicillin as the study of this product has occupied most of my time in the past few years. As far as the otolaryngologic field is concerned, I am sure it is going to have a place in chemotherapy. It has become more apparent that penicillin is not achieving the success hoped for in sinus infection. Penicillin does not pass through the pleural membrane very rapidly. Dr. Tucker used penicillin recently in treating a child with bronchiectasis and achieved dramatic results. At the present time my colleagues and I have no established routine for the use of penicillin by otologists. We do have patients with pulmonary abscess whose condition has improved with the systemic administration of penicillin alone. The use of penicillin against pneumococcic meningitis has proved to be of limited value. Although our experience is not extensive with the treatment of mastoiditis, we feel it is necessary to explore mastoid processes which give indications of being acutely infected. We have seen otitis media develop during the time we were treating patients with penicillin. The statement made by Dr. Cunning that he felt that in the future penicillin might take the place of sulfonamide compounds I take exception to. The sulfonamide compounds are much more easily given. It may at some time be indicated that penicillin and the sulfonamide compounds should both be used. We have not yet determined the use of penicillin as a chemotherapeutic agent, and it remains to be determined, also, how it should be used in conjunction with the sulfonamide compounds.

Dr. John L. Kolmer (by invitation): In view of the possibility of bacterial antagonism, separate micro-organisms secured in cultures are grown in broth mediums for about five days for the production of exogenous toxins in the preparation of autogenous vaccines. These cultures are then used in equal proportions to give a total of about 1,000,000,000 micro-organisms per cubic centimeter, followed by sterilization with phenol in 0.5 per cent concentration at 37 C. for eighteen to twenty-four hours. Exogenous toxins, probably partially converted into toxoids by phenol, are always included because of their well known high vaccinogenic activity. The chemically killed bacteria are also included for the possible production of immune opsonins, bacteriolysins, agglutinins and other antibacterial antibodies.

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Manuscripts for publication, books for review and correspondence relating to the editorial management should be sent to Dr. George M. Coates, Chief Editor, 1721 Pine Street, Philadelphia, or to any other member of the Editorial Board. Communications regarding subscriptions, reprints, etc., should be addressed, ARCHIVES OF OTOLARYNGOLOGY, American Medical Association, 535 North Dearborn Street, Chicago 10.

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The ARCHIVES OF OTOLARYNGOLOGY is issued monthly. The annual subscription price (for two volumes) is as follows: domestic, $6.00; Canadian, $6.40; foreign, $7.00, including postage. Single copies are 75 cents, postpaid.

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